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Two New Dioecious Species of *Symplocos* (Symplocaceae) from Southern Brazil

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Abstract. Two new dioecious species of *Symplocos* Jacquin from southern Brazil are described and illustrated. Both species belong to section *Barberina* (Vellozo) A. DC. of subgenus *Symplocos*. *Symplocos bidana* Aranha is characterized by its cymose or racemose inflorescences (9.5–)11–34 mm long, corolla with five or six lobes 3.7–4.9 mm long, and fruits (10–)13–20 × 5–10 mm with the calyx lobes covering the fruiting disc. *Symplocos incrassata* Aranha is characterized by its reduced cymes, bracts caducous in fruit, and fruits 12–18 × (5–)6–8 mm. In addition, both species have thick endocarps (0.8–1.2 mm), a notable character among the Brazilian species of section *Barberina*.

Resumo. Duas novas espécies dióicas de *Symplocos* Jacquin do sul do Brazil são descritas e ilustradas, do subgênero *Symplocos*, seção *Barberina* (Vellozo) A. DC. *Symplocos bidana* Aranha é reconhecida por sua inflorescência cimosa ou racemosa (9.5–)11–34 mm compr., corola com 5 a 6 lobos com 3.7–4.9 mm compr., e frutos (10–)13–20 × 5–10 mm com lobos do cálice cobrindo o disco no fruto. *Symplocos incrassata* Aranha é reconhecida por suas cimeiras reduzidas (4–7 mm compr.), brácteas caducas no fruto, e fruto 12–18 × (5–)6–8 mm. Além disso, as novas espécies são distintas pela espessura de seus endocarpos, 0.8–1.2 mm, raro entre as espécies brasileiras de *Barberina*.

Key words: IUCN Red List, sect. *Barberina*, southern Brazil, Symplocaceae, *Symplocos*.

Symplocos Jacquin, one of two genera of the monophyletic family Symplocaceae (Fritsch et al., 2008), comprises ca. 318 species distributed mainly in tropical and subtropical regions of America, southern and eastern Asia, Australia, and the East Indies. Several species occur in the temperate zones of eastern Asia and the southeastern United States (Occhioni, 1974; Wang et al., 2004; Fritsch et al., 2006, 2008).

The two species here described both belong to *Symplocos* subg. *Symplocos* sect. *Barberina* (Vellozo) A. DC. (sensu Fritsch et al., 2008), a monophyletic group with ca. 26 species (including those described here) in the Americas and one species in eastern Asia

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(Fritsch et al., 2008). The section is characterized by a basally connate corolla, stamens that are adnate to the corolla only at the base and either completely distinct or united only at the base, terete filaments, a 3-carpellate ovary, hermaphroditic or with a dioecious breeding system (morphologically androdioecious through similar appearance of staminodes to stamens in flowers of female plants), a 1-locular fruit with one seed, rarely 2- or 3-locular with two or three seeds, and an embryo with the radicle longer than the cotyledons, rarely shorter than the cotyledons (Brand, 1901; Fritsch et al., 2008).

Although staminate and pistillate flowers are morphologically distinct, they share several characteristics. To avoid repetition in the descriptions, we first describe the flowers generally, stating the shared features, and then describe the features specific to staminate and pistillate flowers separately in turn.

1. **Symplocos bidana** Aranha, sp. nov. TYPE: Brazil. Paraná: Mun. Quatro Barras, Morro Mãe Catira, 17 Aug. 1989, *R. Kummrow & O. S. Ribas 3170* (holotype, MBM; isotypes, NY not seen, SPF). Figure 1.

Haec species quoad habitum, foliorum formam magnitudinem indumentumque ac fructum satis grandem *Symplocoti variabili* Martius ex Miquel ut videtur arcte affinis, sed ab ea lobulis corollinis majoribus 5 vel 6 in sicco parce atropunctatis, lobulis calycinis in fructu discum obtegentibus atque endocarpio crasso distinguitur.

Evergreen dioecious shrub or tree, 1.5–10 m tall; branchlets strongly angled, ridged, striate, transversely and longitudinally strongly fissured, glabrous; vegetative buds glabrous. Leaves simple, alternate, petiolate, stipules lacking; petioles (8–)10–35 mm, adaxially rounded or rarely concave, abaxially convex, glabrous; leaf blades elliptic to broadly elliptic, occasionally ovate or rarely oblanceolate, 3.5–13 × 1.2–5.5 cm, coriaceous, dark green adaxially, green abaxially, glabrous, venation ± brochidodromous, midvein impressed or slightly elevated on both surfaces, base attenuate, margin conspicuously serrate to inconspicuously serrulate with (1 to 8)9 to 14 teeth, rarely entire, revolute, marginal glands often caducous, apex acute, acuminate to obtuse with acumen, rarely obtuse or retuse, acumen (when present) 3–14 mm, apical gland caducous or less often persistent. Inflorescences axillary, cymose or racemose, (9.5–)11–34 mm, 3- to 16-flowered, glabrous, peduncle 5–30 mm; bracts early caducous, numerous, strongly imbricate and forming a closed and conical structure 7–12 mm, 4–6 × 4–5 mm, glabrous, margin ciliate to ciliolate, apical gland usually absent. Flowers 4.7–6.5(–7) mm, hypanthium glabrous. Pedicel 0.5–3 mm, articulated; bracteoles early caducous, 1 or 3 per flower, obovate or ovate, flat to vaguely concave, 2.5–3 × 1.5–2 mm, glabrous, margin ciliolate, apex obtuse-rounded, apical gland lacking. Calyx lobes 5, oblong to obovate, erect, 1–1.7 × 1.5–2 mm, glabrous, margin ciliate or occasionally ciliolate. Corolla tube 0.5–0.6 mm, lobes 5 or 6, erect, white, ± oblong, concave, 3.7–4.9 × 3.5–5.5 mm, glabrous, densely papillose mainly near the margin, dark dots sparsely distributed mainly on the proximal half of the adaxial surface (in dried specimens), margin ciliate to ciliolate. Stamens and staminodes adnate to the corolla mostly in clusters alternate with the lobes; filaments erect, the longer series exceeding the style and stigma (when the latter are present in staminate flowers), glabrous. Disc flat, 5-lobed, smooth, glabrous. Staminate flowers: hypanthium (0.5–)1.3–1.5 mm; stamens in 3 to 6 series of different lengths, (25 to 34)35 to 50(51 to 60), 25 to 50 stamens alternate with the corolla lobes, 0 to 10 stamens opposite the corolla lobes, 1.5–6 mm; filaments completely distinct or connate portion up to 0.4 mm; ovary aseptate or with 1 to 3 incomplete septa; style usually present or rarely lacking, straight to curved, occasionally bifurcate, to 3 mm, glabrous; stigma obsolete; disc 0.6–0.8 mm diam. Pistillate flowers: hypanthium 2–2.2(–2.5) mm; staminodes in 2 to 4 series of different lengths, 13 to 18, 13 to 15 alternate with the corolla lobes, 0 to 3 opposite the corolla lobes, 1.5–3 mm; filaments completely distinct or connate portion up to 0.5 mm; style straight, 1.7–2.3 mm, glabrous; stigma capitate or 3-lobed; disc 0.7–1.1 mm diam. Drupe ellipsoid or occasionally ovoid, (10–)13–20 × 5–10 mm, glabrous; calyx lobes lying above or occasionally tightly appressed to disc; disc not visible; endocarp 0.8–1.1 mm thick; seed ellipsoid, 6–13 mm, circular in cross section, rugose, in dried specimens flattened and crescent-shaped.

Distribution and habitat. *Symplocos bidana* is known from northeastern Paraná State to northeastern Santa Catarina State, growing in Mata Atlântica rainforest of the Serra do Mar. This species dwells in elfin forest (to ca. 2000 m elevation), occurring also on the lower slopes (ca. 900 m elevation) in ombrophilous forest.

IUCN Red List category. *Symplocos bidana* occurs mostly in protected areas in Paraná (e.g., Parque Estadual Pico Paraná and Parque Estadual Pico Marumbi), but in Santa Catarina it occurs outside protected areas. Our field observations suggest that this species is uncommon, but there are no data regarding estimates of population numbers or sizes. Therefore, we recommend a conservation status of Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

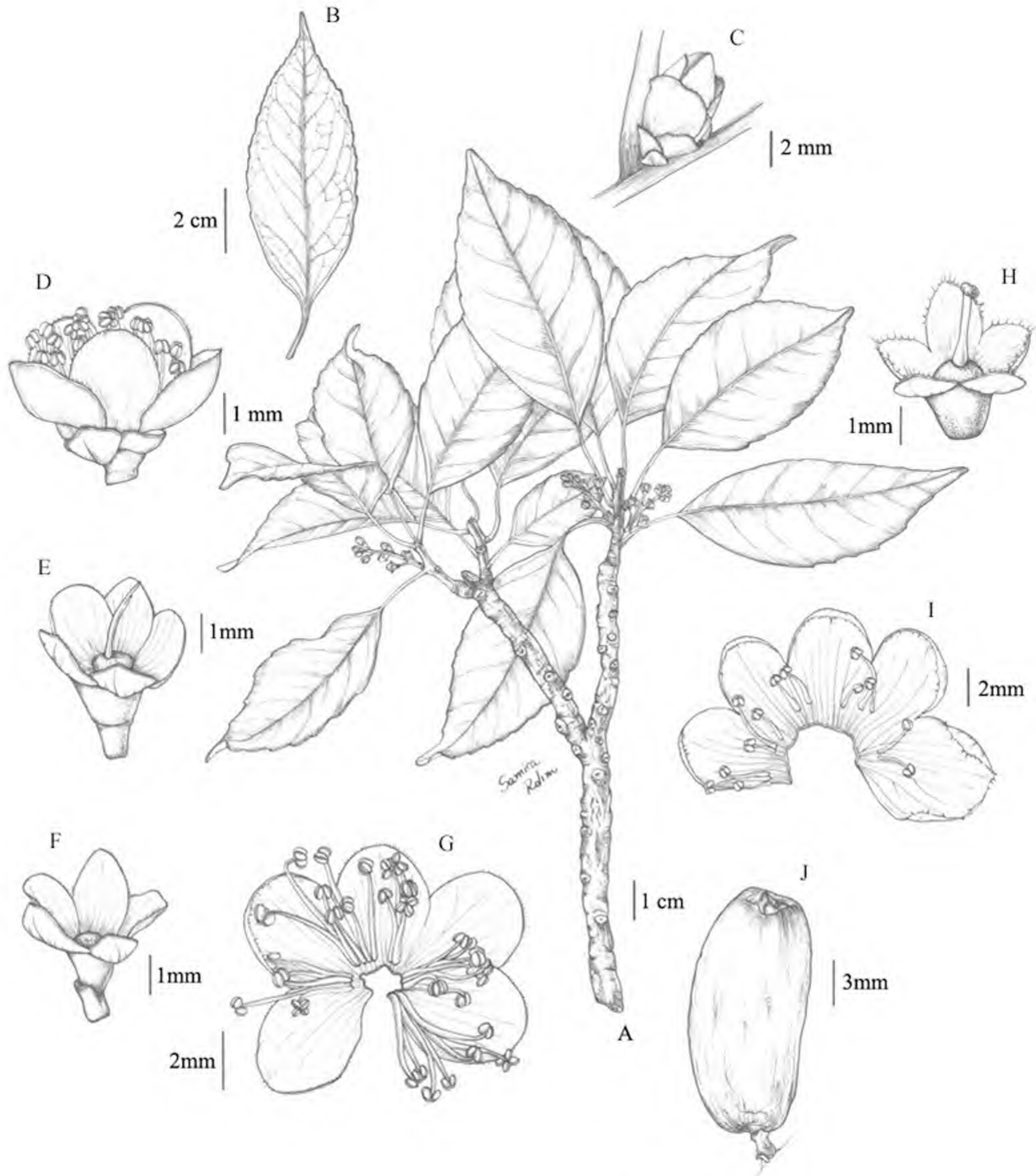

Figure 1. *Symplocos bidana* Aranha. —A. Flowering branch. —B. Representative leaf (abaxial surface). —C. Bracts. —D. Staminate flower at anthesis. —E. Staminate flower with corolla and androecium removed to show ovary apex and nonfunctional style. —F. Staminate flower with corolla and androecium removed to show ovary apex and the absence of style and stigma. —G. Staminate flower corolla opened outward to show epipetalous stamens. —H. Pistillate flower with corolla and androecium removed to show ovary apex, style, and stigma. —I. Pistillate corolla opened outward to show epipetalous staminodes. —J. Mature fruit. (A–F, drawn from the holotype *Kummrow & Ribas 3170*, MBM; G, *Dala Rosa 3*, UPCB; H, I, *Soares & Maschio 148*, MBM; J, *Stange 79*, UPCB.)

Phenology. Flowering in May to October; fruiting in September to December.

Etymology. The specific epithet honors Adriano Bidá, who has provided important contributions to the knowledge of Brazilian Symplocaceae. Dr. Bidá dedicated his professional life to teaching and research at the Universidade Federal do Paraná. He is now retired and currently lives in Curitiba.

Discussion. *Symplocos bidana* is characterized by its large inflorescences (9.5–)11–34 mm long, corolla with five to six lobes, lobes 3.7–4.9 mm long with sparse black dots mainly on the proximal half of the adaxial surface (in dried specimens), large fruit ([10–]

13–20 × 5–10 mm), calyx lobes covering the disc in fruit, and thick endocarp (0.8–1.1 mm).

Based on its habit, leaf shape, size, and indument, and relatively large fruit, the latter feature uncommon among Brazilian species of *Symplocos* sect. *Barberina*, we hypothesize that *S. bidana* is closely related to *S. variabilis* Martius ex Miquel. *Symplocos variabilis* can be distinguished from *S. bidana* by its three or four corolla lobes that are smaller (2.5–3 mm long) and without black dots in dried specimens, calyx lobes that do not cover the disc in fruit, and endocarp less than 0.5 mm thick.

Paratypes. BRAZIL. **Paraná:** Morretes, *S. Dala Rosa 3* (UPCB); Quatro Barras, Morro Mãe Catira, *R. Kummrow & J. Cordeiro 3040* (G, MBM); Morretes, Serra da Igreja, *A. Y. Mocochinski & M. B. Scheer 231* (MBM, UPCB); Campina Grande do Sul, Serra do Ibitiraquire, *O. S. Ribas, J. M. Silva & E. Barbosa 1495* (HB [2], MBM, SJRP, UPCB), *O. S. Ribas, J. M. Silva & E. Barbosa 1520* (G, HB, K, MBM, NY, RB, UPCB); Morretes, Parque Estadual Marumbi, *A. Soares & W. Maschio 148* (MBM); along a trail on W slope of Morro do Canal, *P. W. Fritsch, J. L. M. Aranha Filho & E. Barbosa 1806* (CAS, UEC); Piraquara, Morro do Canal, *E. J. Stange 79* (UPCB). **Santa Catarina:** Botuverá, Morro do Barão, *R. Reitz & R. M. Klein 17990* (UPCB).

2. Symplocos incrassata Aranha, sp. nov. TYPE: Brazil. Paraná: Pico Caratuva, Mun. Campina Grande do Sul, 2 Aug. 1967, *G. Hatschbach 16821* (holotype, MBM; isotypes, HB, K [2] not seen, MBM, NY [3] not seen). Figure 2.

Haec species quoad cymam deminutam *Symplocoti itatiaiae* Wawra simillimis, sed ab ea bracteis in fructu caducis, fructu majore atque endocarpio crasso distinguitur.

Evergreen dioecious shrub, occasionally a small tree, 0.7–3 m tall; densely branched, branchlets angled, ridged, striate, transversely and longitudinally fissured, glabrous; vegetative buds glabrous. Leaves simple, alternate, petiolate, stipules lacking; petioles 2.5–10 mm, adaxially slightly to moderately concave, abaxially rounded to occasionally convex, glabrous; leaf blades elliptic to obovate, 1.5–4.5 × 0.6–1.6 cm, coriaceous, dark green adaxially, green abaxially, both surfaces sparsely to densely puberulent or glabrous, venation ± brochidodromous, midvein impressed to somewhat elevated on both surfaces, base cuneate to attenuate, margin entire or inconspicuously serrulate with 1 to 5 teeth, revolute, marginal glands often caducous, apex usually hooked, acuminate or occasionally acute, rarely obtuse or retuse, acumen (when present) 1–3 mm, apical gland caducous or less often persistent. Inflorescences axillary, cymose, 4–7 mm, 1- to 3-flowered, rarely 4- or 5-flowered, glabrous, peduncle 1–2 mm (1–3[–4] mm when 1-flowered); bracts persistent at anthesis and caducous in fruit, numerous, imbricate, spreading outward and forming a cylindrical and open or less often globose structure 2.5–3 mm, 0.9–1.5 × 1–2.2 mm, glabrous, margin ciliate to ciliolate, apical gland lacking. Flowers 3.5–4.3(–5) mm, hypanthium glabrous. Pedicel nearly absent to 1 mm, articulated; bracteoles early caducous, 1 or 2 per flower, deltoid or occasionally ovate, concave, 0.8–1.2 × 0.8–1.2 mm, glabrous, margin ciliolate, keeled, apex acute or occasionally obtuse, apical gland lacking. Calyx lobes 5, oblong to nearly deltoid, erect, 1.3–1.6 × 0.8–1.2 mm, glabrous, margin ciliate or occasionally ciliolate. Corolla tube 0.4–0.6 mm, lobes 5, erect, white, ± oblong, concave, 2.5–3.4 × 1–3.8 mm, glabrous, obscurely and sparsely papillose mainly near the margin, margin entire or occasionally sparsely ciliolate. Stamens and staminodes adnate to the corolla mostly in clusters alternate with the lobes; filaments erect, the longer series exceeding the style and stigma (when the latter are present in staminate flowers), glabrous. Disc flat, obscurely 5-lobed, smooth, glabrous. Staminate flowers: hypanthium 0.6–1 mm; stamens in 3 to 6 series of different lengths, (24 to 26)27 to 35, 24 to 28 alternate with the corolla lobes, 0 to 7 opposite the corolla lobes, 0.8–4.5 mm; filaments completely distinct or connate portion up to 0.5 mm; ovary aseptate or with 1 to 3 incomplete septa; style usually lacking, when present straight or curved, sometimes bifurcate, to 2 mm, glabrous; stigma obsolete; disc 0.6–1 mm diam. Pistillate flowers not seen. Drupe ellipsoid, 12–18 × (5–)6–8 mm, glabrous; calyx lobes erect, rarely incurved but not tightly appressed to disc; disc usually visible; endocarp 0.9–1.2 mm thick; seed ellipsoid, 8–10 mm, circular in cross section, rugose, in dried specimens flattened and crescent-shaped.

Distribution and habitat. *Symplocos incrassata* has been collected only near Curitiba in the eastern region of Paraná State. This species grows in the Serra do Mar, dwelling mainly in elfin forest (ca. 2000 m elevation) and rarely in ombrophilous forest at 1500 m elevation.

IUCN Red List category. *Symplocos incrassata* is poorly sampled in herbaria and our field observations suggest that this species is rare, but there are no detailed data regarding estimates of population numbers or sizes. Fortunately, the new species is protected within Parque Estadual Pico Paraná. The extent of occurrence is less than 5000 km^2 and there are fewer than five localities known. Therefore, we recommend a conservation status of Endangered (EN B1a) according to IUCN Red List criteria (IUCN, 2001).

Phenology. Flowering in July to September; fruiting in October to November.

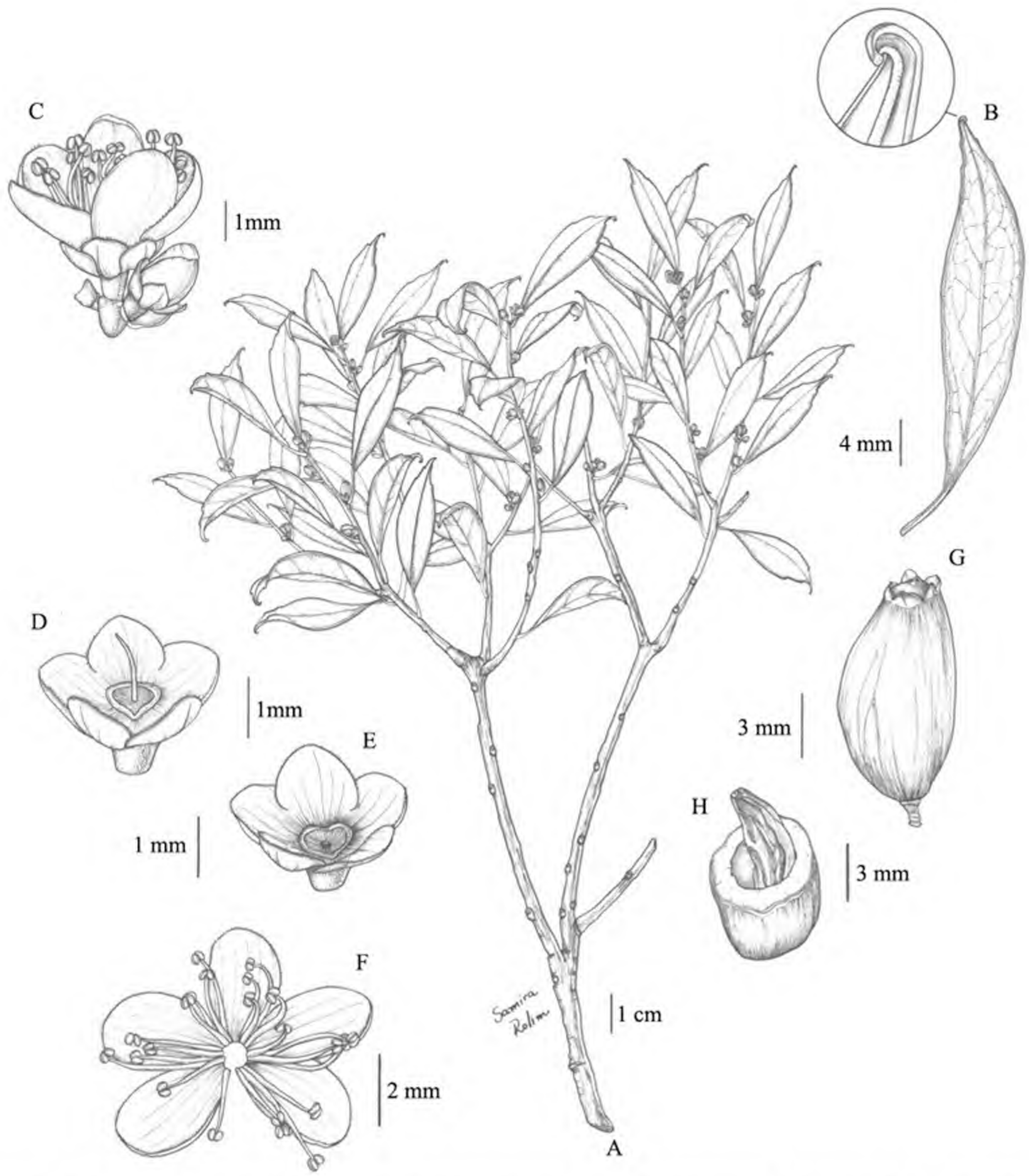

Figure 2. *Symplocos incrassata* Aranha. —A. Flowering branch. —B. Representative leaf (abaxial surface) and apex enlargement. —C. Staminate flower at anthesis, flower bud, and subtending bracteole. —D. Staminate flower with corolla and androecium removed to show ovary apex and nonfunctional style. —E. Staminate flower with corolla and androecium removed to show ovary apex and the absence of style and stigma. —F. Staminate corolla opened outward to show epipetalous stamens. —G. Mature fruit. —H. Mature fruit in cross section with dried seed. (A–F, drawn from the holotype *Hatschbach 16821*, MBM; G, H, *Ribas & Dittrich 2188*, MBM.)

Etymology. The specific epithet is from the Latin for "thickened," in reference to its relatively thick endocarp, rare among section *Barberina* species.

Discussion. Although pistillate flowers are unknown in *Symplocos incrassata*, this species must nonetheless be functionally dioecious, like the majority of probably all Brazilian section *Barberina* species (Aranha Filho et al., 2009). The staminate flowers often lack a style, and when the style is present the stigma is obsolete. Moreover, staminate flowers almost always lack ovules, and when they are present they are reduced and in all likelihood nonfunctional because in male plants only old flowers have been observed, without any apparent development of young fruit.

Symplocos incrassata is characterized by its small cymes 4–7 mm long, bracts caducous in fruit, large fruits (12–18 × [5–]6–8 mm), and thick endocarp (0.9–1.2 mm). Among the species of *Symplocos* sect. *Barberina*, only *S. itatiaiae* Wawra has the type of

diminutive cyme observed in *S. incrassata*. *Symplocos itatiaiae* can be distinguished from *S. incrassata* by its persistent bracts in fruit, smaller fruits (6–7 × 3–4 mm), and an endocarp less than 0.2 mm thick.

Paratypes. BRAZIL. **Paraná:** Campina Grande do Sul, Serra do Ibitiraquire, *O. S. Ribas, J. M. Silva & E. Barbosa 1500* (G, HB [3], K, MBM, NY, SPF, UPCB); trail to Pico Caratuva, *P. W. Fritsch, J. L. M. Aranha Filho & E. Barbosa 1828* (CAS, UEC); Antonina, Serra do Ibitiraquire, *O. S. Ribas & V. A. O. Dittrich 2188* (B, HRCB, MBM, SPF).

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Caryodaphnopsis fieldii (Lauraceae), a New Species from the Coastal Cordillera of Venezuela

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Abstract. A new species of *Caryodaphnopsis* Airy Shaw from Henri Pittier National Park, in the Coastal Cordillera of Aragua State, Venezuela, is described and illustrated, and its morphological relationships with allied species are discussed. *Caryodaphnopsis fieldii* Aymard & G. A. Romero resembles *C. fosteri* van der Werff, but it is distinguished by leaves with densely puberulent petioles and a rounded apex, pedicels 2–3 mm long, inner tepals 3–4.5 mm long and densely sericeous inside, stout filaments ca. 2 mm long, inner stamens with two globose glands attached at the base, and the pubescent ovary. Geographical information about the Coastal Cordillera region and a key to the Neotropical species of *Caryodaphnopsis* are presented. This species represents the first report of this genus for Venezuela.

Resumen. Una nueva especie de *Caryodaphnopsis* Airy Shaw del Parque Nacional Henri Pittier, en la Cordillera de la Costa, estado Aragua, Venezuela, es descrita e ilustrada, y sus relaciones morfológicas con las especies afines son discutidas. *Caryodaphnopsis fieldii* Aymard & G. A. Romero es similar a *C. fosteri* van der Werff, sin embargo, se diferencia de esta especie por sus pecíolos densamente puberulentos, el ápice redondeado; los pedicelos 2–3 mm de largo; los tépalos internos 3–4.5 mm de largo, densamente seríceos internamente, los filamentos gruesos, ca. 2 mm de largo, los estambres internos con dos glándulas globosas situadas en la base del filamento, y el ovario pubescente. Se presenta información geográfica acerca de la Cordillera de la Costa y una clave de las especies Neotropicales de *Caryodaphnopsis*. Esta nueva especie representa el primer registro del género para Venezuela.

Key words: *Caryodaphnopsis*, Coastal Cordillera, IUCN Red List, Lauraceae, Venezuela.

Caryodaphnopsis Airy Shaw is a tropical amphi-Pacific genus of Lauraceae (van der Werff & Richter, 1985) that shows a remarkable disjunction between Southeast Asia (southern China, Vietnam, Laos, Cambodia, the Philippines, and Indonesia) and tropical America (Costa Rica, Panama, Colombia, Ecuador, Peru, and Brazil, and reported herein for Venezuela). *Caryodaphnopsis* is characterized among genera of Lauraceae by its opposite leaves and six strongly unequal tepals, the outer three being much smaller than the inner three (van der Werff & Richter, 1985; van der Werff, 1991a; van der Werff & Dao, 1999). In addition, *Caryodaphnopsis* has an interesting wood anatomical feature: the presence of pyramidal calcium oxalate crystals in the ray parenchyma cells (Richter, 1981; van der Werff & Richter, 1985), which is present in the Old World species of the genus, but not found in the Neotropical species (F. Lorea, pers. comm., 2008). Most species have 4-locellate anthers (vs. 2-locellate in other *Caryodaphnopsis* [vs. other Lauraceae]), nine stamens (vs. six), and tripliveined leaves (vs. penniveined).

The Coastal Cordillera

The Coastal Cordillera (Cordillera de la Costa) is the third largest mountain range in Venezuela, extending approximately 800 km from its western extreme in the Turbio-Yaracuy depression, where it separates from the Venezuelan Andes, to its eastern end at the tip of the Peninsula de Paria in the state of Sucre. Because of their proximity, the Coastal Cordillera and the Venezuelan Andes have sometimes been considered a continuous mountain chain. However, these two cordilleras do not share a common geologic history; the Coastal Cordillera is ca. 65 million years old, whereas the northern Andes complex is ca. 20 million years old (González de Juana et al., 1980; F. Urbani, pers. comm., 2006). The northern limit of the Coastal Cordillera is the Caribbean coastline, and to the south we find vast plains known as Los Llanos. The summits and

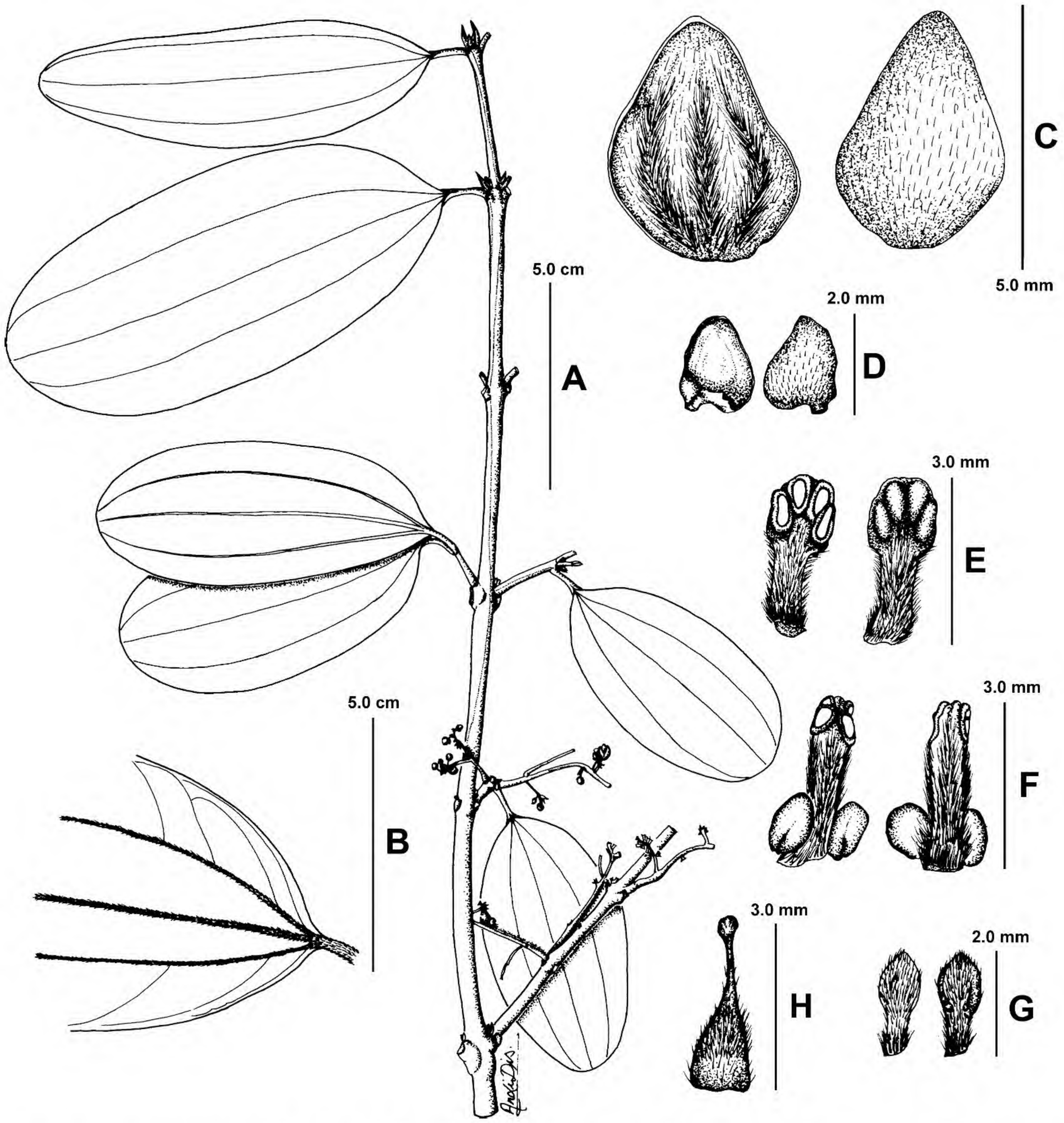

Figure 1. *Caryodaphnopsis fieldii* Aymard & G. A. Romero. —A. Branch with leaves and inflorescences. —B. Basal portion of a leaf, showing the sparse pilosity on the abaxial side, more dense along the main and secondary veins, and the dense, short pubescence on the petiole. —C. Inner tepals. —D. Outer tepals. —E. Outer stamens. —F. Inner stamens. —G. Staminodia. —H. Ovary. Drawn from the isotype *A. Field 442* (NY).

uppermost slopes of the Coastal Cordillera are mostly covered by humid cloud forest, which extend between 600 and 2000 m. Deciduous and humid low forest are also found in this region, scrub and low forests are present in the arid coastal region, and savannas and herbaceous formations occur on lower slopes, mainly in the interior valleys and plains. Steyermark (1982) studied the Coastal Cordillera flora and concluded that, in addition to endemic taxa, the vegetation of this region was a blend of Central American, Caribbean, Andean, and Guayanan-Amazonian elements. According to Huber et al. (1998), the region holds between 3000 and 3500 species of vascular plants, of which ca. 278 were noted as endemic.

Caryodaphnopsis fieldii Aymard & G. A. Romero, sp. nov. TYPE: Venezuela. Aragua: Distrito Girardot, Parque Nacional Henri Pittier, cloud forest, 1180 m, July 1984, *A. Field 442* (holotype, MY; isotypes, MERF, NY). Figure 1.

Species *Caryodaphnopsidi fosteri* van der Werff accedens, sed ab ea petiolis dense puberulis, foliis apice rotundatis, pedicellis 2–3 mm longis, tepalis interioribus 3–4.5 mm

longis, intus dense sericeis, filamentis validis ca. 2 mm longis, antheris interioribus glandulis globosis duabus basi adhaerentibus atque ovario pubescente diversa.

Tall trees; twigs quadrangular to slighty terete, densely puberulent, glabrescent when mature. Leaves opposite, chartaceous, elliptic to elliptic-oblong, 6–12 × 3–6 cm, base acute to cuneate, apex rounded, glabrous adaxially, sparsely pilose abaxially, more densely along the main and secondary veins; blades triplinerved, the basal lateral veins leaving the midrib 1–3 mm from the base of the leaf, lateral and secondary venation slightly impressed adaxially, raised abaxially, tertiary venation immersed on both surfaces; petioles 6–12 mm, densely short pubescent. Inflorescence axillary, paniculate with alternate branches, 2.5–5 cm; peduncles ridged, sparsely pilose; flowers pediceled, pedicels 2–3 mm, densely adpressed pubescent, with 2 triangular bracteoles at the base. Tepals 6, strongly unequal, the outer 3 1–2 mm, wide-ovate, sparsely strigose externally, glabrous internally, the inner 3 3–4.5 mm, ovate, 6-veined, adpressed pilose externally, densely sericeous internally; fertile stamens 9; filaments ca. 2 mm, stout, densely sericeous; anthers 4-locellate, the locelli arranged in 2 horizontal rows with the lower pair larger than the upper, introrse in the outer 6 stamens, extrorse in the inner 3, these with 2 globose glands attached at the base; staminodia 3, 1.5–2 mm, filaments densely sericeous, tip triangular; ovary ca. 1 mm, sparsely pilose at the base, strigose from the middle to the apex; style ca. 1 mm, slender; stigma capitate. Fruit not seen.

Distribution and habitat. *Caryodaphnopsis fieldii* is known only from the type specimen, collected in Aragua State, Venezuela, in the central portion of the Coastal Cordillera, in moist montane forests dominated by trees of *Gyranthera caribensis* Pittier (Malvaceae) that are up to 50 m tall (Huber, 1986; Smith & Field, 2001). It may be common in this area, but the great height of the trees surely has discouraged collectors.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the new species should be included in the category LC (Least Concern) at the regional level, because it is legally protected within Henry Pittier National Park, Aragua State, Venezuela.

Etymology. The specific epithet honors the collector of the type, Andrew M. Field (1955–1984), pioneer of forest canopy studies in Venezuela, who died when he accidentally fell from a *Gyranthera caribensis* tree while conducting canopy research in August 1984 (Bordón, 1987).

Discussion. *Caryodaphnopsis fieldii* shares the following characters with *C. fosteri*: rachis of the inflorescence and pedicels sparsely to densely adpressed pubescent, inflorescences not longer than 6 cm, and ovary ca. 1 mm long. However, *C. fieldii* is distinguished from *C. fosteri* by petioles densely short pubescent (vs. slightly pilose); apex of the leaves rounded (vs. obtuse to acute); pedicels 2–3 mm long (vs. ca. 5 mm long); inner tepals 3–4.5 mm long, densely sericeous inside (vs. 5–6 mm long, pilose inside); filaments stout, ca. 2 mm long (vs. slender, 3–4 mm long); the inner stamens with two globose glands attached at the base (vs. two glands attached ca. 1 mm above the base); and the ovary pubescent (vs. glabrous).

Including the new species described here, *Caryodaphnopsis* currently comprises 15 species. The Asian species were revised by Kostermans (1974), and a key for known species was written in Chinese by Li and Li (1991). Since Kostermans revised the Asian species, eight new species (including *C. fieldii*) have been described in or transferred to *Caryodaphnopsis*, one from Vietnam and the others from the Neotropics (van der Werff & Richter, 1985; van der Werff, 1986, 1988, 1991b; van der Werff & Dao, 1999; Zamora et al., 1988). However, the genus as a whole has never been revised. The following key facilitates the identification of the Neotropical species. It is based on original descriptions and on the examination of specimens deposited in the New York Botanical Garden, the Missouri Botanical Garden, and the Harvard University Herbaria.

KEY TO THE NEOTROPICAL SPECIES OF *CARYODAPHNOPSIS*

1a. Leaves penniveined.
  2a. Anthers 2-celled; leaves oblong to elliptic, not glaucous abaxially; Amazonian Brazil, Peru, Colombia . . . . . *C. inaequalis* (A. C. Smith) van der Werff & H. G. Richter
  2b. Anthers 4-celled; leaves elliptic, gray-glaucous to glaucous abaxially.
    3a. Apex of the leaf acute; rachis of the inflorescence ferruginous pubescent; filaments glabrous; Antioquia, Colombia . . . . . *C. cogolloi* van der Werff
    3b. Apex of the leaf mainly obtuse, sometimes acute; rachis of the inflorescence puberulent; filaments pubescent; Colombia, Ecuador. . . . . *C. theobromifolia* (A. H. Gentry) van der Werff & H. G. Richter
1b. Leaves tripliveined.
  4a. Leaves glaucous abaxially; Colombia, Ecuador . . *C. theobromifolia* (A. H. Gentry) van der Werff & H. G. Richter
  4b. Leaves not glaucous abaxially.

5a. Flowers with 6 fertile stamens; leaves coriaceous, densely brown tomentose abaxially; Ecuador, Peru . . . . . *C. tomentosa* van der Werff

5b. Flowers with 9 fertile stamens; leaves chartaceous to subcoriaceous, sparse to densely shortly pilose abaxially.

6a. Leaf apex acute or acuminate to cuspidate; inner tepals 7–10 mm long; ovary ca. 1.9 mm long with sparse sericeous pubescence; Costa Rica, Panama . . . . . *C. burgeri* N. Zamora & Poveda

6b. Leaf apex acute or rounded; inner tepals 3–6 mm long; ovary ca. 1 mm long, glabrous or pubescent.

7a. Petioles slightly pilose; pedicels ca. 5 mm long; inner tepals 5–6 mm long, sparsely pilose inside; filaments slender, 3–4 mm long; the inner stamens with 2 globose glands attached ca. 1 mm above the base; ovary glabrous; Colombia, Ecuador, Peru, Bolivia . . *C. fosteri* van der Werff

7b. Petioles densely short pubescent; pedicels 2–3 mm long; inner tepals 3–4.5 mm long, densely sericeous inside; filaments stout, ca. 2 mm long; the inner stamens with 2 globose glands attached at the base; ovary pubescent; Coastal Cordillera, Venezuela. . . . . *C. fieldii* Aymard & G. A. Romero

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Cinnamodendron occhionianum, a New Species of Canellaceae from Brazil

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Abstract. A new species belonging to the genus *Cinnamodendron* Endlicher (Canellaceae) is described: *C. occhionianum* F. Barros & J. Salazar. The new species is known only from Cardoso Island off the coast of southeastern Brazil. It is similar to *C. axillare* Endlicher ex Walpers and *C. sampaioanum* Occhioni, but differs from the former by the fasciculate inflorescence and dark purple flowers, and from the latter by the nonplicate apex of the leaves and a shorter fruit pedicel. It also resembles *C. dinisii* Schwacke in its vegetative features, but differs from it mainly by the flowers with 10 petals, 10 stamens, and ovary with two placentae.

Resumo. Uma nova espécie do gênero *Cinnamodendron* Endlicher (Canellaceae) é descrita e ilustrada, com o nome *C. occhionianum* F. Barros & J. Salazar. A nova espécie é conhecida, até o momento, somente da Ilha do Cardoso, no litoral sudeste do Brasil. Ela é próxima de *C. axillare* Endlicher ex Walpers e *C. sampaioanum* Occhioni, mas difere da primeira pela inflorescência em fascículo e flores purpúreas, e da segunda pelo ápice das folhas não plicado e pedicelo dos frutos mais curto. Lembra *C. dinisii* Schwacke no seu aspecto vegetativo, mas difere principalmente pelas flores com 10 pétalas, 10 estames e ovário com duas placentas.

Key words: Brazil, Cardoso Island, Canellaceae, *Cinnamodendron*, IUCN Red List.

Canellaceae is a small tropical family with ca. 21 species in six genera. Six species belonging to the two genera, *Canella* P. Browne and *Cinnamodendron* Endlicher, have been found in South America so far. Only *Cinnamodendron* is represented in Brazil, and its distribution extends into French Guiana, Suriname, and Venezuela. *Capsicodendron* Hoehne, a monotypic genus from Brazil described by Hoehne (1934), has been shown to be a synonym of *Cinnamodendron* (Hutchinson, 1964; Barroso et al., 1978; Salazar, 2006).

Cinnamodendron is characterized by axillary inflorescences with flowers that are mainly fasciculate, rarely racemiform to corymbiform, with three conspicuous bracts, three sepals, six to 10 free petals (generally 10) arranged in two series, eight to 10 stamens (commonly 10), two or three carpels, two or three placentae, few ovules (four to six), and small fruit up to 1.5 cm in diameter (one of the smaller fruits in the family). The fruit is commonly stipitate with few seeds (one to six) that are embedded in a gelatinous pulp and do not have a ruminate endosperm.

Five species of *Cinnamodendron* are currently recognized (Salazar, 2006): *C. axillare* Endlicher ex Walpers, *C. dinisii* Schwacke, *C. sampaioanum* Occhioni, *C. tenuifolium* Uittien, and *C. venezuelense* Steyermark. The first three species occur in Brazil, where the highest diversity of the genus is found (Salazar, 2006). Herein, a sixth species (fourth for Brazil) for the genus is described, based on collections from the state of São Paulo, southeastern Brazil.

Cinnamodendron occhionianum F. Barros & J. Salazar, sp. nov. TYPE: Brazil. São Paulo: Cananéia, Ilha do Cardoso, 12 Aug. 2004 (fl., fr.), *F. Barros, J. Salazar & R. P. Romanini 3080* (holotype, SP; isotypes, BH, MO). Figure 1.

Affine *Cinnamodendron axillari* Endlicher ex Walpers sed floribus fasciculatis purpureis differt; affine etiam *C. sampaioano* Occhioni sed apice foliorum non plicato atque pedicellis fructuum brevioribus differt; etiam simile *C. dinisii* Schwacke sed petalis staminibusque 10 atque ovario placentis 2 et ovulis 4 differt.

Tree, 8–20 m tall; bark brownish gray with abundant rounded reddish brown lenticels. Leaves with petiole contorted at the base, canaliculate above, 5–10 mm; blade ± symmetrical, bicolored, oblong-lanceolate to obovate-lanceolate, apex obtuse to

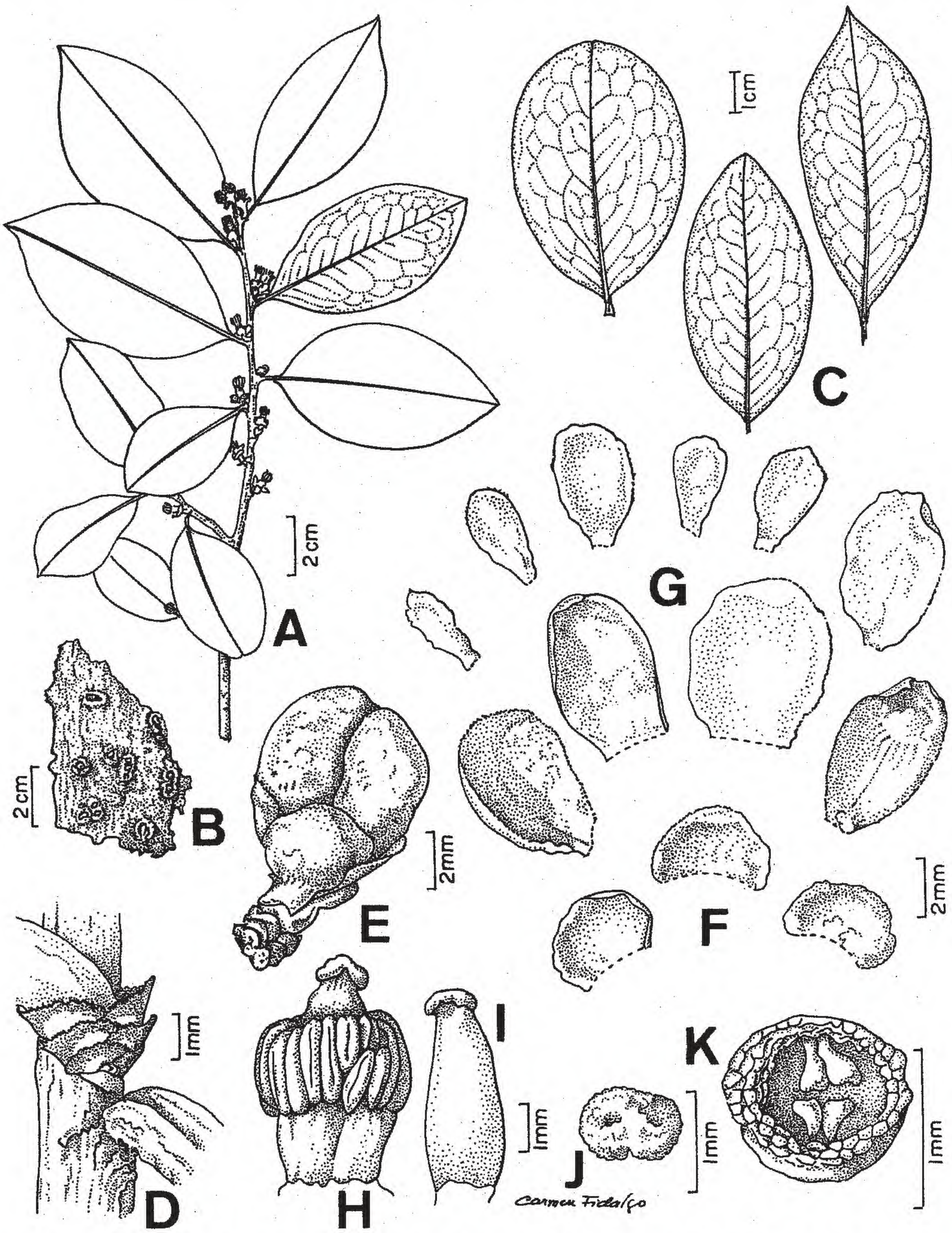

Figure 1. *Cinnamodendron occhionianum* F. Barros & J. Salazar. —A. Flowering branch. —B. Detail of the bark, showing lenticels. —C. Variation of leaf forms. —D. Leaf axil and base of the inflorescence, showing the imbricate bracts. —E. Flower bud. —F. The three sepals. —G. The 10 petals, the innermost ones above. —H. Staminal tube surrounding the gynoecium. —I. Gynoecium. —J. Stigma viewed from above. —K. Ovary in transverse section, showing the ovules. Drawn from *F. Barros & L. Rossi 1884* (SP).

acuminate, base obtuse to attenuate; chartaceous, glabrous, glandular dotted on both surfaces, with the glands more prominent abaxially, (3.5–)8–11(–15) × (2–)2.9–5(–6.5) cm, adaxial surface glossy and dark, abaxial surface opaque and pale; midvein prominent abaxially, 8 to 10 secondary veins on each side, slightly impressed adaxially, but prominent abaxially; stomata brachyparacytic. Inflorescence as fascicles of

Table 1. Principal differences among the four Brazilian species of *Cinnamodendron*.

	C. occhionianum	*C. axillare*	*C. dinisii*	*C. sampaioanum*
Inflorescence	fascicle of 1 to 4 flowers	raceme of 3 to 8 flowers	fascicle of 2 to 6 flowers	solitary flowers or fascicle of 2 to 3 flowers
Flower color	dark purple	whitish cream	dark purple	purple
Leaf apex	obtuse to acuminate, not plicate	acute to subacuminate, not plicate	obtuse to rounded, not plicate	acute, plicate
Flower pedicel length, mm	2–5	4–5	7–9	3–6
Fruit pedicel length, mm	2–5	8–10	5–7	5–9
No. of petals	10	10	6	10
No. of placentae	2	2	3	2
No. of stamens	10	10	(8)9(10)	10

few flowers (1 to 4); peduncle glabrous, glandular-punctate, with bracts and bracteoles subcoriaceous, caducous, imbricate, slightly ciliolate at the margin and glandular-punctate. Flowers with pedicels 2–5 mm, with glabrous, glandular-punctate, imbricate bracteoles at the base; flowers small, pentamerous, subsessile; sepals 3, green, suborbiculate to orbiculate, 2–3 × 3–4 mm, margin entire to slightly ciliolate; petals 10, free, in 2 series of 5, imbricate, dark purple, fleshy, glandular-punctate, margin slightly ciliolate, the outer 5 petals larger and thicker, 6–7 × 4–5 mm, obovate, the internal 5 petals smaller, more membranaceous, with more glandular punctations, 4–5 × 2–3 mm, obovate to spatulate; androecium with 10 stamens, fused into a staminal tube and monadelphous, 4–5 mm, the base of the staminal tube 3.2–4.5 mm; anthers 1–1.8 mm, inequilateral, apically truncate; gynoecium cylindrical, 5–7 mm; stigma capitate, papillate, bilobate, placentae 2, ovules 4. Fruit a stipitate berry, ca. 1.5 × 1.3–1.5 cm, ± globose, dark purple; pedicels 2 to 5; seeds 2 to 4, dark brown, embedded in a gelatinous pulp, ca. 10 × 8 mm; endosperm not ruminate.

Distribution and ecology. *Cinnamodendron occhionianum* is a tree up to 8–20 m, endemic to Brazil and collected only in São Paulo State from Cardoso Island. It is found in the Atlantic Forest at 120–200 m along the hillsides of the River Perequê cliffs.

IUCN Red List category. *Cinnamodendron occhionianum* should be considered Data Deficient (DD) according IUCN Red List criteria (2001). A number of trees of *C. occhionianum* are known from the forests of Cardoso Island, but no objective measure of its range of distribution or information on the density and size of its population are available. However, because of Cardoso Island's status as a state park, the species is most likely not endangered at this time.

Phenology. The new species has been collected flowering and fruiting from August to November.

Etymology. *Cinnamodendron occhionianum* is named in honor of Paulo Occhioni (1915–2000), the Brazilian botanist who extensively studied the family Canellaceae in Brazil.

Local names and uses. The popular name of the species is "paratudo," from the Portuguese meaning "for all." Its bark is used to aromatize and dye cachaça, a popular Brazilian alcoholic beverage, which is often used to treat rheumatism (Barros, 2000).

Diagnostic features. *Cinnamodendron occhionianum* is similar to *C. axillare* and *C. sampaioanum*, but differs from the former by the fasciculate inflorescence and the dark purple flowers, and from the latter by the nonplicate apex of the leaves and the shorter fruit pedicel. It also resembles *C. dinisii* in its vegetative features and has been frequently confused with it in both literature and herbaria; however, it differs in the flowers that have 10 petals, 10 stamens, and an ovary with two placentae. The differences among these species are summarized in Table 1.

Paratypes. BRAZIL. **São Paulo:** Cananéia, Ilha do Cardoso, trilha para a captação de água, 3 Dec. 1990 (fr.), *F. Barros 2016* (SP); trilha entre a barragem e Ipanema, 9 May 1990, *F. Barros s.n.* (SP238607); trilha para a barragem, 11 Nov. 1990 (fl.), *F. Barros & L. Rossi 1884* (SP); mata da estrada da captação às margens do Rio Perequê, 28 Nov. 1989 (fr.), *M. R. F. Melo & J. A. Correa 727* (SP); morro de captação de água, 20 Aug. 1987, *M. R. F. Melo & A. Penina 917* (SP).

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Una Nueva Especie y Combinación en *Wissadula* (Malvaceae)

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RESUMEN. Se presenta una nueva especie y combinación de Malvaceae, *Wissadula stipulata* Bovini y *W. cuspidata* (R. E. Fries) Bovini, respectivamente. Ambas fueron encontradas en el centro-oeste de Brasil, en las regiones del Pantanal y Amazónica. Se presenta la descripción e ilustración de la nueva especie, y una clave taxonómica para las especies de *Wissadula* en Brasil que están relacionadas. El nombre *W. cuspidata* es lectotipificado.

ABSTRACT. A new species and combination in Malvaceae, *Wissadula stipulata* Bovini and *W. cuspidata* (R. E. Fries) Bovini, respectively, are presented. Both were found in the central-west of Brazil, in the lowlands and Amazon rainforest regions. A description and illustration of the new species are provided, and a taxonomic key of species related to *Wissadula* in Brazil is presented. The name *W. cuspidata* is lectotypified.

Key words: Brazil, IUCN Red List, Malvaceae, Mato Grosso do Sul, *Wissadula*.

El género *Wissadula* Medikus, posee aproximadamente 26 especies (Fryxell, 1997), ocurre básicamente en los neotrópicos, y es reconocido entre las Malvaceae, por poseer un tubo estaminal extremamente reducido y principalmente por el fruto esquizocarpo con mericarpos que presentan una constricción en la región medial, aparentando internamente, una división en dos cavidades de sus mericarpos.

La monografía de Fries (1908) fue la última obra completa para el género. Actualmente, al prepararse una revisión de *Wissadula* para el Brasil, se identificó una nueva especie, y se necesitó establecer una nueva combinación.

Wissadula stipulata Bovini, sp. nov. TIPO: Brasil. Mato Grosso do Sul: Bonito, Projeto Guaicurus, arredores, 14 mar. 2003 (fl., fr.), *G. Hatschbach, M. Hatschbach & E. Barbosa 74690* (holotipo, MBM; isotipo, CTES). Figura 1.

Haec species inter congeneros brasilienses *Wissadulae cuspidatae* (R. E. Fries) Bovini et *W. excelsiori* (Cavanilles) C. Presl maxime accedens, sed ab eis stipulis ca. 1.5 cm latis apice longe acuminatis, lamina foliari in sicco manifeste discolori, corolla ca. 1.8 cm diam., mericarpiis 4 atque semine in quoque mericarpio solitario distinguitur.

Arbusto erecto con 1–2.5 m de altura; ramas jóvenes pubérulas, blanquecinas, brilloso-sedosas, tricomas diminutos glandulares y raramente estrellados. Estípulas lanceoladas, ca. 1.5 cm, ápice largo acuminado, base atenuada y ancha, en pares, persistentes, cara adaxial pubescente, diminutos tricomas simples, cara abaxial pubescente, tricomas estrellados. Hojas simples, enteras, membranáceas a cartáceas; lámina ovada a lanceolada, 4.5–12 × 2.5–6 cm, ápice acuminado a agudo, base cordiforme, con lóbulos hasta 1.2 cm, margen entera, revoluta, ligeramente ciliada, tricomas simples; nervaduras prominentes en el envés; haz marrón oscuro, glabrescente, raros e inconspícuos tricomas glandulares, envés albo-argénteo (cuando secas), tomentoso, tricomas estrellados; pecíolo 0.5–6.5 cm, indumento y tricomas iguales a los de las ramas. Panícula ca. 30 cm, con ramas botriomorfas, laxa; pedicelo hasta 2 cm, antopodio hasta 1 cm, indumento y tricomas iguales a los de las ramas; cáliz campanulado ca. 5 mm, no engrosado en la fructificación, 5 lóbulos ligeramente cuspidados, partidos hasta la porción medial, externamente pubérulo, tricomas estrellados, internamente ligeramente pubérulo, tricomas simples largos, margen densamente vilosa, tricomas simples largos; corola alba a crema, ca. 1.8 cm diám., pétalo espatulado, en la margen con tricomas estrellado-estipitados en la base; filamentos concrescentes formando un tubo estaminal ca. 1 mm, con raros tricomas estrellados estipitados y ca. 5 mm de filamentos libres; anteras amarillas, ca. 1 mm; ovario glabro, 3 óvulos por lóculo; estilo ca. 6 mm, igual al número de mericarpos, estigma capitado. Esquizocarpo ca. 8 mm diám., con 4 mericarpos, ca. 7 mm de altura, siendo menos de 1 mm de arista, constricción casi imperceptible, glabro, brilloso (cuando seco); 1 semilla ca. 2 mm de altura, vilosas en la región del hilo, tricomas largos.

Distribución y fenología. Wissadula stipulata, hasta el presente momento, se restringe al Estado de Mato Grosso do Sul, en la región del Pantanal. En el material examinado, florece y fructifica en el mes de marzo.

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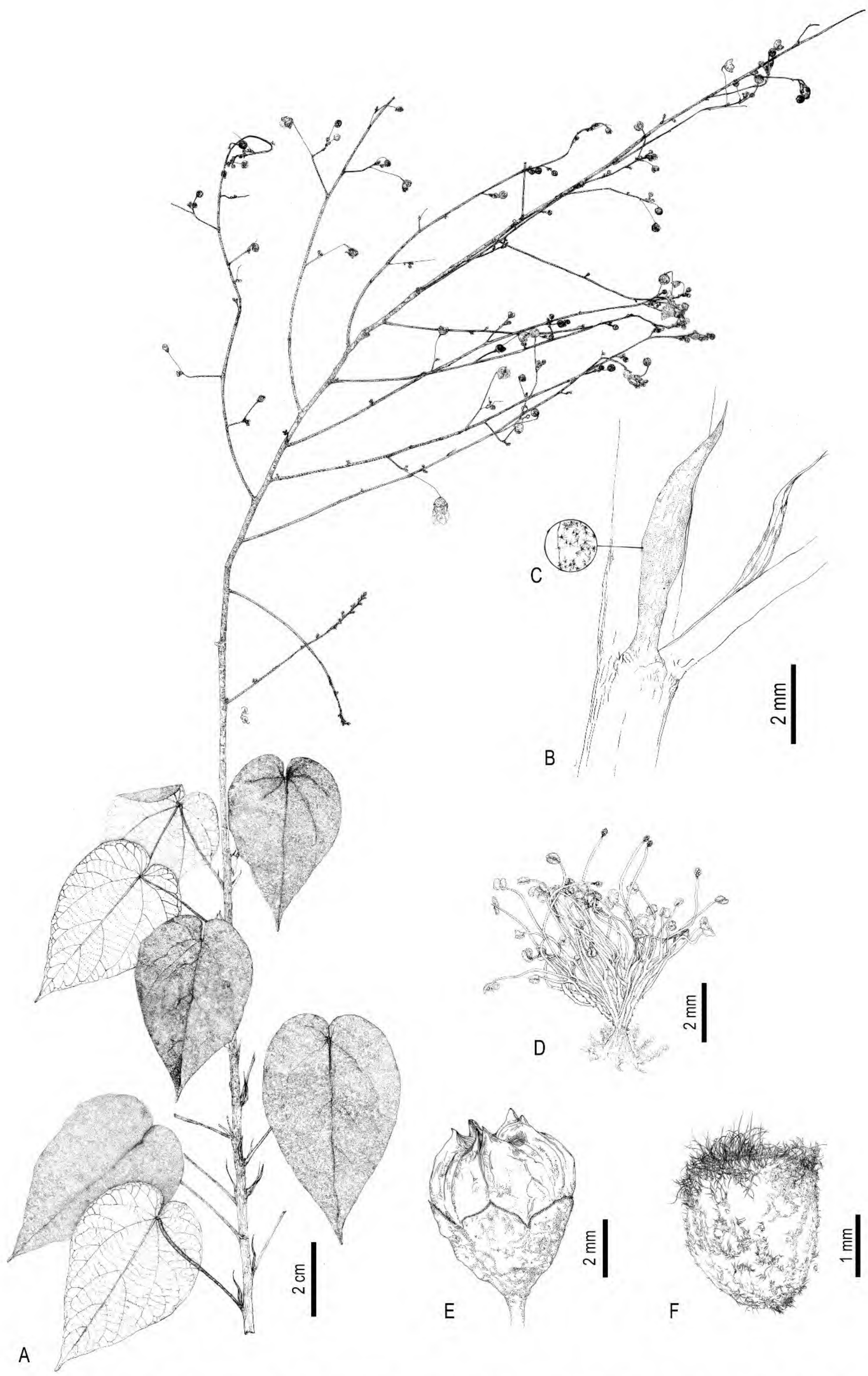

Figura 1. *Wissadula stipulata* Bovini. —A. Rama con flores y frutos. —B. Estípula. —C. Detalle del indumento de la estípula. —D. Gineceo y androceo. —E. Fruto. —F. Semilla. (*G. Hatschbach 74690*, holotipo, MBM.)

Estado de conservación. Hasta el momento *Wissadula stipulata* se encuentra en "Not Evaluated" (NE) de acuerdo con la IUCN (2001). No se cuenta con un estudio y colecciones suficientes de la especie, y sólo se conoce de áreas perturbadas en el mismo municipio.

Etimología. El epíteto se refiere al tamaño prominente de las estípulas.

Discusión. Las características sobresalientes para la especie son las láminas en la región adaxial glabrescentes, tricomas glandulares raros e inconspicuos y en la región abaxial albo-argénteas, y cuando secas, se tornan más evidentes, estípulas ca 1.5 cm de largo, tal vez la mayor observada para el género hasta el momento y esquizocarpo con cuatro mericarpos, glabros, con una semilla en cada mericarpo. Se asemeja a *Wissadula excelsior* (Cavanilles) C. Presl, pero el indumento de la hoja (híspido) y del fruto (tomentoso), la forma de la base de la hoja (truncada a ligeramente cordada), la estípula menor y el número de semillas (tres) por mericarpo, las tornan distintas.

La característica, una semilla por mericarpo es diagnóstica para la sección *Wissada*, siendo conocidas hasta ahora dos especies: *Wissadula divergens* (Bentham) Bentham & Hooker f. (Ecuador) y *W. fadyenii* R. E. Fries (Caribe). En *W. stipulata* probablemente existe un aborto de los dos óvulos colaterales, presentando sólo el desarrollo de la semilla basal. Con base en esta característica de una semilla por mericarpo, *W. stipulata* se considera la tercera especie de la sección *Wissada*.

Paratipo. BRASIL. **Mato Grosso do Sul:** Bonito, rod. Bonito Anastácio, 19 mar. 2004 (fl., fr.), *G. Hatschbach, M. Hatschbach & E. Barbosa 77251* (MBM).

Wissadula cuspidata (R. E. Fries) Bovini, comb. et stat. nov. Basónimo: *Wissadula patens* (A. Saint-Hilaire) Garcke subsp. *cuspidata* R. E. Fries, Kongl. Svenska Vetensk. Handl. 43(4): 43. 1908. TIPO: Brasil. Mato Grosso: Santa Anna da Chapada, 28 jun. 1902 (fl., fr.), *A. Robert 341* (lectotipo, aquí designado, BM).

Fries (1908) analizó algunos ejemplares (*Malme II s.n.*, BM 888516; *Robert 341*, BM; y *Pilger 658*, B [destruido]) y comentó sobre las evidentes diferencias morfológicas y geográficas de éstos en relación a *Wissadula patens*, como hojas con pecíolos más largos, base de la lámina foliar redondeada, ápice cuspidado y con el envés más claro, estableciendo la subespecie *cuspidata*. Además del estudio de estos ejemplares de herbario, fue encontrado otro ejemplar colectado posteriormente en la misma área de ocurrencia, que luego de un minucioso estudio permitió elevarla a nivel de especie.

Como características diagnósticas, *Wissadula cuspidata* posee hojas con haz glabro, ápice agudo a cuspidado y base atenuada, además de presentar una corola menor que la especie mas relacionada, *W. excelsior*.

Material examinado. BRASIL. **Mato Grosso:** Aripuanã, Dardanelos, estrada Sta. Elena, 15 jun. 1974 (fl., fr.), *M. R. Cordeiro 69* (CTES, IAN); Santa Anna da Chapada, 13 jun. 1903 (?) (fl., fr.), *Malme II s.n.* (BM 888516).

Clave Para el Reconocimiento de las Especies de *Wissadula* Relacionadas en Brasil

1a. Estípulas ca. 1.5 cm largo, ápice largo acuminado; lámina foliar nítidamente discolor (cuando seca); corola ca. 1.8 cm de diám.; una semilla por mericarpo. . . . . *W. stipulata*
1b. Estípulas ca. 1 cm de largo, ápice agudo; lámina foliar levemente discolor; corola ca. 1 cm de diám. o menos; tres semillas por mericarpo 2
2a. Haz de la lámina foliar glabra; base atenuada; corola ca. 0.9 cm de diám. . . . . .*W. cuspidata*
2b. Haz de la lámina foliar híspida; base truncada a ligeramente cordada; corola ca. 1.1 cm de diám. . . . . *W. excelsior*

Agradecimientos. A los profesores Giovani R. Milla y Mauricio S. Yepes, por la traducción del artículo al español, a la ilustradora Rachel Rosadas por la confección de la lámina y a Tarciso Filgueiras por la diagnosis en latín.

Literatura Citada

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Three New Species of *Brachystelma* (Apocynaceae, Asclepiadoideae, Ceropegieae) from South Tropical and Southern Africa

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ABSTRACT. Three new species of *Brachystelma* Sims (Apocynaceae, Asclepiadoideae, Ceropegieae) are described and illustrated. These are *B. pruinosum* Bruyns from the mountains of southern Angola and the Kaokoveld of northern Namibia, *B. tenuissimum* Bruyns from central Tanzania and northern Zambia, and *B. theronii* Bruyns from the western parts of the Great Karoo of South Africa.

Key words: Apocynaceae, Asclepiadoideae, *Brachystelma*, Ceropegieae.

Brachystelma Sims (Apocynaceae, Asclepiadoideae, Ceropegieae) consists of some 100 species that are widely distributed in sub-Saharan Africa. More than 70 of these 100 species occur in southern Africa (Dyer, 1980; Bruyns, 1995), but there are a few species in southeastern Asia, and one occurs as far east as Australasia (Forster, 1996). These taxa are mostly poorly recorded because the plants are geophytes that only appear above the ground during the rainy season and, even when in full growth, they are small and inconspicuous.

1. Brachystelma pruinosum Bruyns, sp. nov. TYPE: Namibia. Okombambi (1712BD), 1800 m, 20 Dec. 1999, *P. V. Bruyns 8021* (holotype, BOL; isotypes, K, WIND). Figure 1.

Haec species *Brachystelmati incano* R. A. Dyer simillima, sed ab eo caulibus erectioribus, foliis angustioribus, pagina interiore corollae laevi et lobis exterioribus coronae profundius bifidis differt.

Small herb arising from flattened discoid tuber to 5 cm diam.; *stems* ascending to erect and mostly unbranched, 5–10 × 0.1–0.2 cm, puberulous, reddish green. *Leaves* narrowly elliptic, 15–25 × 3–8 mm, green, puberulous, petiole to 5 mm. *Inflorescences* 1 to 5, alongside many of lower nodes except first 2 above tuber, each with tiny peduncle to 3 mm, with 3 to 10 flowers opening in gradual succession; pedicel 10–15 mm, brownish green, puberulous, initially ascending then spreading and later descending to hold flower facing somewhat downward, lowest flowers held very close to ground. Flowers with sepals ca. 2 × 1 mm, lanceolate, acute, adpressed to corolla, puberulous, brownish green; *corolla* rotate, 5–8 mm diam., outside green suffused with black, puberulous, inside purple-brown, brown in patch toward apex of lobes, pubescent toward center (and in sinuses of and along margins of lobes) with fine white spreading crinkled trichomes, 0.5–1 mm, of which those near center cling to sides of corona; *corolla tube* cupular, ca. 0.5 mm deep and just containing base of gynostegium; *corolla lobes* 2–3 × 1.5–2 mm at base, reflexed, deltate to ovate-deltate, broadly acute, margins recurved and eciliate; *corona* ca. 1.75 × 2 mm, glabrous, white

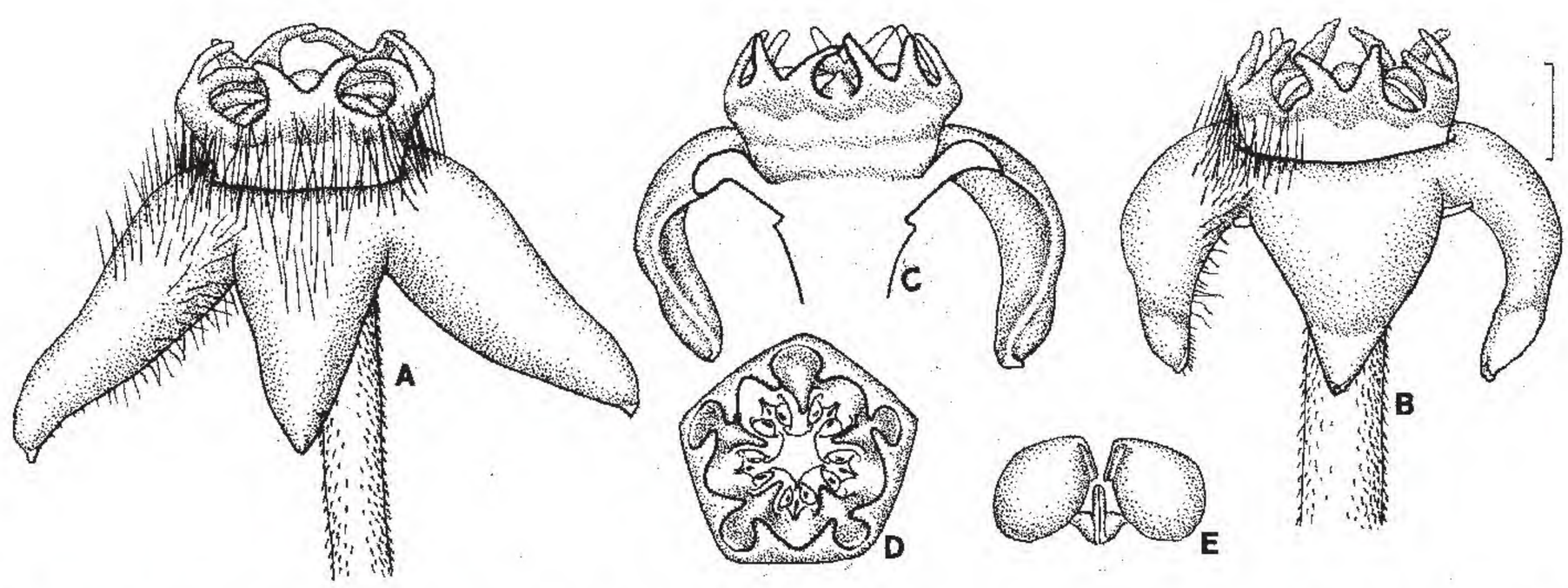

Figure 1. *Brachystelma pruinosum* Bruyns. —A, B. Side views of flower. —C. Side view of dissected corolla. —D. Face view of gynostegium. —E. Pollinarium. Scale bar, at B: A–D = 1 mm; E = 0.25 mm. A drawn from *Bruyns 10661* (BOL, E); B–E, from *Bruyns 8021* (BOL, K, WIND).

outside in lower half, without basal stipe; *outer lobes* ca. 1 mm, bifid to near middle into spreading flattened obtuse lobules, black; *inner lobes* less than 0.5 mm, adpressed to backs of anthers and shorter than them, narrowly deltoid, acute, black. *Fruits* and *seeds* unknown.

Habitat and distribution. *Brachystelma pruinosum* has been collected twice: one collection was made in the Kaokoveld of Namibia at the top of the Otjihipa Mountains and the other collection hails from the adjacent part of southwestern Angola (Fig. 4), where it occurred around the base of larger granite hills among trees. In both cases, it grew among rocks and a sparse covering of grasses and other small herbs in gently sloping areas.

IUCN Red List category. *Brachystelma pruinosum* should be considered Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Discussion. *Brachystelma pruinosum* is most similar to *B. incanum*. In both species, the small, dark flowers are borne in small clusters on comparatively long pedicels. The two differ by the spreading habit of the stems of *B. incanum* with much broader leaves 10–15 mm across, the rugose inner surface of the corolla in *B. incanum* (smooth in the new species), and the more deeply bifid outer corona lobes of *B. pruinosum* (which are not bifid in *B. incanum*). *Brachystelma pruinosum* is unusual in the genus for the fine, crinkled, white hairs, which are plentiful near the center of the corolla, many of which cling to the sides of the gynostegium.

Superficially, there is some resemblance also to *Brachystelma arnotii* Baker and to *B. schinzii* (K. Schumann) N. E. Brown. In *B. arnotii*, the outer and inner coronas arise much lower on the gynostegium, the outer lobes do not form a cup around the anthers as in *B. pruinosum*, and the inner lobes are extremely short so that the anthers are left exposed in the center nearly to their bases. *Brachystelma schinzii* differs by the presence of pendulous marginal cilia along the lobes and the short outer corona lobes that do not rise above the level of the anthers.

Paratype. ANGOLA. North of Chitado (1613DD), 1220 m, 4 Jan. 2007, *P. V. Bruyns 10661* (BOL, E).

2. Brachystelma tenuissimum Bruyns, sp. nov. TYPE: Tanzania. Mpwapwa distr.: Kiboriani Hills (0636AD), 1500 m, 16 Dec. 2003, *P. V. Bruyns 9641* (holotype, BOL). Figure 2.

Haec species a *Brachystelmate elegantulo* S. Moore floribus in pluries fasciculos parvos dispositis, lobis corollae 5–6 mm longis et lobis coronae exterioribus profunde bifidis in lobulos lineares patentes differens.

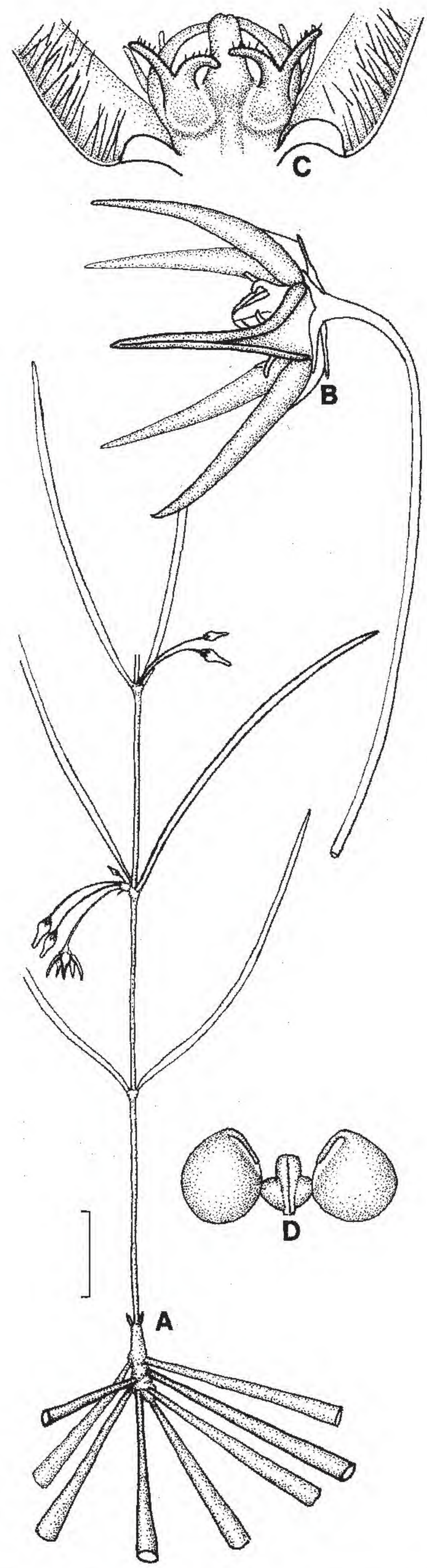

Figure 2. *Brachystelma tenuissimum* Bruyns. —A. Plant, somewhat reduced in length. —B. Side view of corolla. —C. Side view of base of dissected corolla. —D. Pollinarium. Scale bar, at A: A = 15 mm; B = 2 mm; C = 1 mm; D = 0.25 mm. A–D drawn from *Bruyns 9641* (BOL).

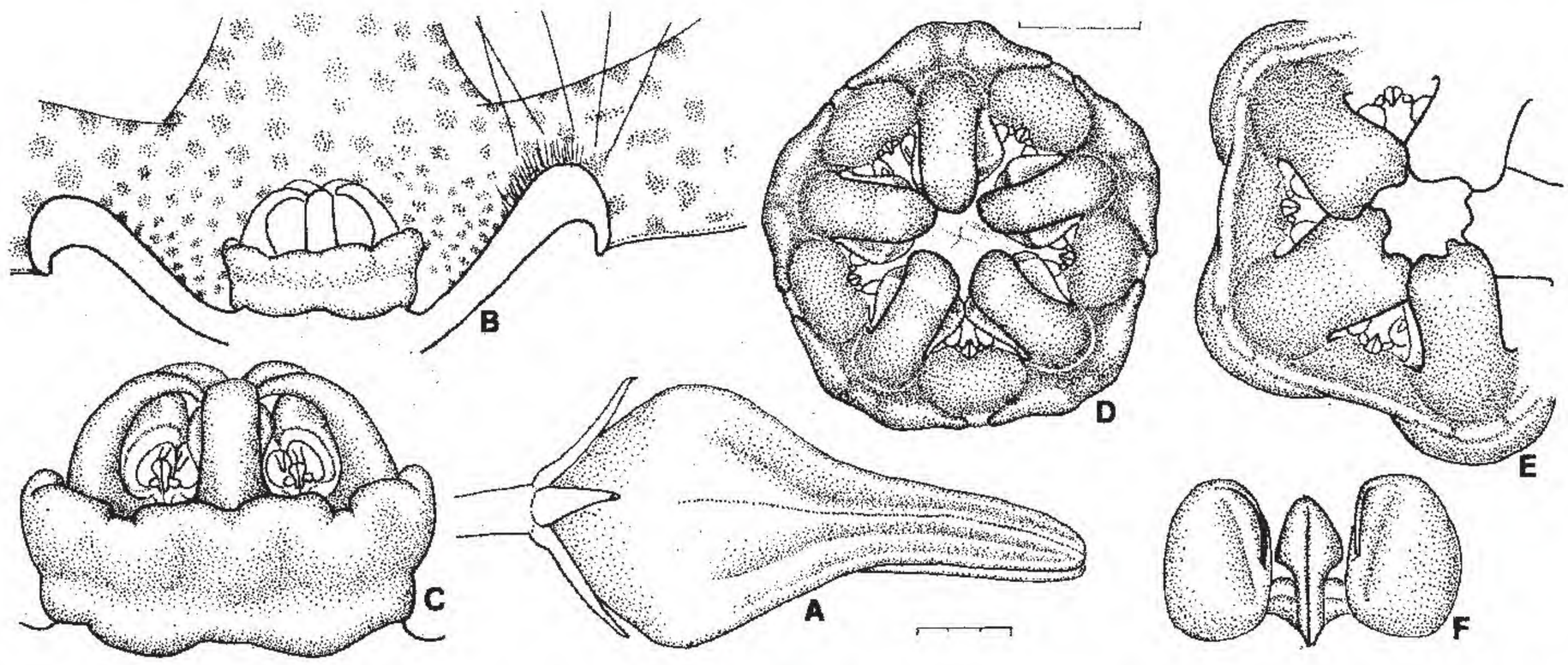

Figure 3. *Brachystelma theronii* Bruyns. —A. Bud. —B. Side view of center of dissected flower. —C. Side view of gynostegium. —D, E. Face view and detail of gynostegium. —F. Pollinarium. Scale bars: A = 3 mm; B = 2 mm (at D); C–E = 1 mm (at D); F = 0.25 mm (at A). A, E, drawn from *Bruyns & Theron 4839* (BOL); B–D, F from *Bruyns 3708* (BOL).

Small herb with single stem arising from cluster of thickened, swollen, whitish roots; *stem* erect and unbranched, 15–45 × 0.1–0.2 cm, glabrous, green. *Leaves* filiform, 20–65 × 2–3 mm, grayish green, nearly glabrous, slightly folded upward along midrib, sessile. *Inflorescences* 1 to 5, in small fascicles alongside middle to upper nodes, each with short peduncle to 3 mm, with 3 to 6 flowers opening in gradual succession; pedicel 12–17 mm, green, sparsely puberulous, descending. Flowers with sepals ca. 1.5 × 0.5 mm, narrowly lanceolate, acute, adpressed to corolla, sparsely puberulous, green; *corolla* rotate to slightly campanulate, 8–10 mm diam., outside green, glabrous, inside purple, finely pubescent with purple spreading trichomes up to 0.5 mm; *corolla tube* less than 0.25 mm deep (almost absent); *corolla lobes* 5–6 × 0.8–1 mm at base, ascending to slightly spreading, narrowly lanceolate, acuminate, with erect purple cilia (not swollen) along slightly recurved margins; *corona* ca. 1.8 × 2.25 mm, glabrous except for small hairs on lobules of outer corona, with short basal stipe; *outer lobes* ca. 1 mm, ascending, deeply bifid into 2 widely spreading linear lobules and fused to inner lobes only near base; *inner lobes* nearly 1 mm, adpressed to backs of anthers and exceeding them to meet in center, linear, obtuse. *Fruits* and *seeds* unknown.

Habitat and distribution. Brachystelma tenuissimum is known at present from two widely scattered localities: one in central Tanzania and the other on the northern edge of Zambia, near Lake Tanganyika (Fig. 4). It occurs in *Brachystegia*-woodland on steep to gently sloping ground among stones under trees, with very little other vegetation.

IUCN Red List category. Brachystelma tenuissimum should be considered Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Discussion. Brachystelma tenuissimum is one of the species of *Brachystelma* in which the stems arise from a fascicle of swollen roots rather than a tuber. Dyer (1980) listed *B. canum* R. A. Dyer, *B. comptum* N. E. Brown, *B. franksiae* N. E. Brown, *B. gerrardii* Harvey, *B. longifolium* (Schlechter) N. E. Brown, *B. macropetalum* (Schlechter) N. E. Brown, *B. natalense* (Schlechter) N. E. Brown, *B. ramosissimum* (Schlechter) N. E. Brown, *B. sandersonii* (Oliver) N. E. Brown, and *B. schizoglossoides* (Schlechter) N. E. Brown as possessing this form of rootstock in southern Africa. Other tropical African species with this habit are *B. brownianum* (S. Moore) Meve from Angola and possibly *B. elegantulum* S. Moore from Angola. Outside Africa, this phenomenon is only known in *B. nepalense* (Radcliffe-Smith) Meve from the Himalayas of Nepal.

Some of these species were at one stage accommodated in the genera *Brachystelmaria* Schlechter and *Lasiostelma* Bentham, but were placed in *Brachystelma* by N. E. Brown (1902, 1908–1909). It has been shown (Meve & Liede, 2001) that *B. franksiae*, *B. macropetalum*, and *B. schizoglossoides* are nested among other species of *Brachystelma*, and so this species is also described as a species of *Brachystelma*.

Of all of these, *Brachystelma tenuissimum* is most similar to *B. elegantulum*, but differs in that the flowers are produced in several small fascicles along the stem (rather than terminally as in *B. elegantulum*), the corolla lobes are 5–6 mm long (vs. 12–15 mm long in *B. elegantulum*), and the outer corona lobes are pouch-like in *B. elegantulum* rather than divided into two spreading lobules as in this new species.

Paratype. ZAMBIA. Near Kalombo Falls (0831CA), 1200 m, 6 Dec. 2003, *Bruyns 9603* (BOL).

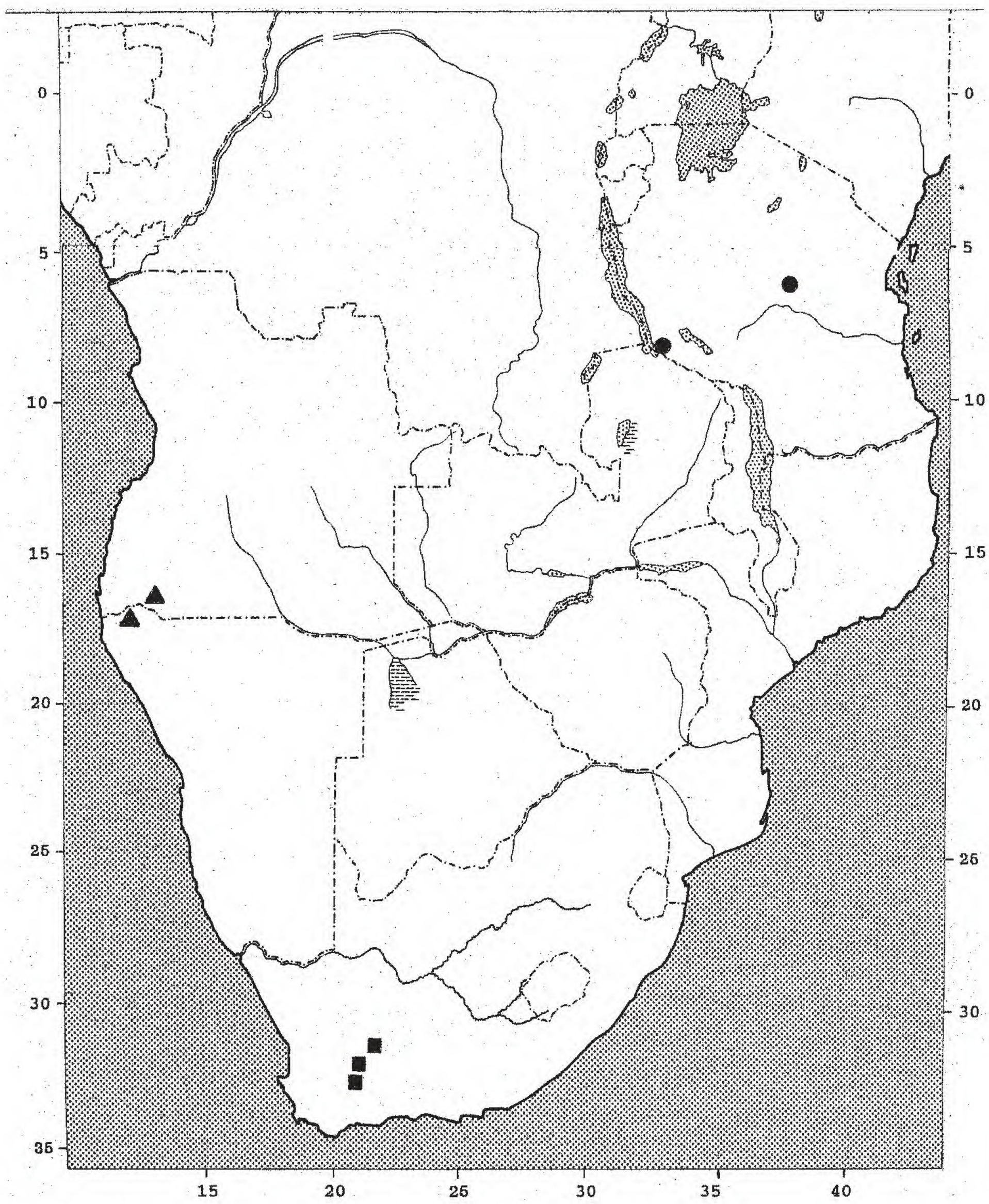

Figure 4. Known distribution of the three new species of *Brachystelma*. Triangles = *B. pruinosum*; circles = *B. tenuissimum*; squares = *B. theronii*.

3. Brachystelma theronii Bruyns, sp. nov. TYPE: South Africa. Fraserburg distr.: Tafelberg (3221AA), 1400 m, 2 Nov. 1991, *P. V. Bruyns & A. S. Theron 4839* (BOL). Figure 3.

Haec species *Brachystelmati caudato* (Thunberg) N. E. Brown similis, sed ab eo floribus simul aperientibus, tubo corollae minus profundo, lobis coronae exterioribus non profunde bifidis et tumore nullo post lobos interiores coronae distinguenda.

Small herb to 10 cm tall arising from flattened discoid tuber to 12 cm diam.; *stems* ascending to erect and branching near base, 5–10 × 0.1–0.2 cm, puberulous, gray-green. *Leaves* narrowly elliptic, 15–50 × 3–10 mm, gray-green, puberulous, petiole 4–6 mm. *Inflorescences* 1 to 3, alongside lower nodes except first 2 above tuber, each with short peduncle to 5 mm long, with 3 to 20 flowers opening nearly simultaneously usually in a dense cluster; pedicel 10–18 mm, green, puberulous, ascending to hold flower facing upward. Flowers with sepals ca. 5 × 1 mm, narrowly lanceolate, acute, adpressed to corolla, puberulous, green; *corolla* rotate to slightly campan-

ulate, 30–45 mm diam., outside green faintly mottled with brown, puberulous, inside cream mottled with maroon, covered especially around mouth of tube and inside tube with shaggy white spreading hairs 0.5–3 mm long, with foetid odor; *corolla tube* shallow and bowl-shaped, 2–3 mm deep and completely containing gynostegium; *corolla lobes* 15–20 × 4–6 mm at base, spreading, narrowly lanceolate, acuminate, margins slightly recurved and eciliate; *corona* ca. 2.5 × 3.5–4 mm, glabrous, apparently blackish red (actually dark yellow heavily suffused with maroon flecks), with very short basal stipe; *outer lobes* ca. 0.75 mm, forming almost continuous ring around gynostegium with slight notch in middle, distinctly thicker behind inner lobes; *inner lobes* nearly 1 mm, adpressed to backs of anthers and exceeding them, rectangular, obtuse to emarginate, slightly descending beyond anthers. *Fruit* a pair of slender follicles 80–100 × 3–4 mm, each horn of follicle bearing 18 to 25 flattened shiny blackish comose seeds, ca. 6 × 3 mm.

Habitat and distribution. *Brachystelma theronii* is found among dolerite-capped, shale hills at altitudes of 1000–1400 m on the western edge of the Great Karoo between Laingsburg and Williston (Fig. 4). Plants grow on gently sloping ground among stones and scattered small, nonsucculent shrubs, usually completely in the open and mostly around the bases of the larger hills.

IUCN Red List category. *Brachystelma theronii* should be considered Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Etymology. *Brachystelma theronii* is named for A. S. Theron, who has for many years documented the flora of his own farm, Tafelberg, in the Fraserburg district of the western Great Karoo, and neighboring areas and has discovered many interesting new records of succulents and other plants in this little-collected corner of the country. Among these is this new species of *Brachystelma*.

Discussion. *Brachystelma theronii* shares many features with *B. caudatum* and has flowers of a similar size to those of *B. caudatum*. It differs from *B. caudatum* in that the flowers are produced in nearly simultaneously opening clusters, which mature before the leaves have fully developed, usually around the middle of October. In *B. caudatum* (which also flowers in October), the flowers are produced in fascicles of two to eight among the mature leaves and open successively, the corolla tube is deeper (roughly twice the height of the gynostegium) and has steeper sides, the outer corona lobes are deeply bifid with an erect tooth on either side of the divide, and the inner lobes have a distinct swelling behind them inside the cup formed by the outer lobes.

From *Brachystelma decipiens* N. E. Brown, *B. theronii* differs by the much larger flowers (to 25 mm diam. in *B. decipiens*) with their shallowly bowl-shaped corolla tube (more cup-shaped in *B. decipiens*) and the manner in which the flowers are produced in simultaneously opening clusters (developing successively in groups of two to four in *B. decipiens*). In *B. decipiens*, the outer corona lobes are also deeply divided in the middle (unlike *B. theronii*) and have a dense cluster of white hairs on their inner faces (lacking in *B. theronii*).

Paratypes. SOUTH AFRICA. **Fraserburg distr.:** Korfplaas (3121CB), 1200 m, 1 Dec. 1991, *P. V. Bruyns 4875* (BOL). **Laingsburg distr.:** near Klipfontein (3221CC), 1050 m, 19 Mar. 1988, *P. V. Bruyns 3708* (BOL).

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Validation of the Name *Sinoleontopodium lingianum* (Asteraceae, Gnaphalieae)

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ABSTRACT. *Sinoleontopodium lingianum* Y. L. Chen (Asteraceae, Gnaphalieae), originally described from Xizang (Tibet), China, was not validly published in 1985 because two gatherings were designated as type. The name is validated here, with the specimen bearing female florets designated as holotype.

Key words: Asteraceae, Gnaphalieae, IUCN Red List, *Sinoleontopodium*.

Sinoleontopodium lingianum Y. L. Chen, the basis for the monotypic genus *Sinoleontopodium* Y. L. Chen, was described based on material from Xizang (Tibet), China (Chen, 1985). Unfortunately, this publication was not in accordance with Articles 37.1 and 37.2 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006), since two gatherings, one with female florets and the other with male florets, were cited concurrently as type. Article 37.1 requires the type to be clearly indicated for the name of a species published after 1957. Article 37.2 allows the type to be indicated by reference to a single gathering, even if more than one specimen is involved. However, nothing in Article 37 allows the type to be indicated by reference to more than one gathering. Although the collection information is quite similar for both specimens, the sites do differ, being glacial gravel, 4500 m, or cliff, 4600–4900 m, respectively. In such an instance, the name is not validly published because Article 32.1(e) requires compliance with the special provisions of Article 37 (among others).

Sinoleontopodium is a distinctive genus recognized widely since its publication (e.g., Ni & Cheng, 1987; Anderberg, 1991; Ying & Zhang, 1994). Chen (1985) considered that, in the habit and the shape of the involucre, this genus is very similar to some Sino-Himalayan species of *Leontopodium* R. Brown, particularly to those in *Leontopodium* ser. *Haastioidea* Ling, in *Leontopodium* subsect. *Haastioidea* Handel-Mazzetti, such as *L. haastioides* (Handel-Mazzetti) Handel-Mazzetti, but readily distinguishable by the plants being dioecious and having homogeneous florets, the corolla white villous distally, and achenes 1-costate on each side. As well, Chen (1985) also pointed out that *Sinoleontopodium* may be more closely related to *Antennaria* Gaertner than to *Leontopodium* in the plants being dioecious, but differs in having pappus hairs not connate at the base, receptacles areolate with the areoles cup-shaped, corollas white villous distally, and involucral bracts thinly membranous. However, Anderberg (1991) later segregated *Sinoleontopodium*, together with five genera from New Zealand, Tasmania, and South America, namely *Psychrophyton* Beauverd, *Pterygopappus* Hooker f., *Loricaria* Weddell, *Raouliopsis* S. F. Blake, and *Mniodes* (A. Gray) Bentham, in the subtribe Loricariinae Anderberg in the tribe Gnaphalieae Bentham. The systematic position of *Sinoleontopodium* remains unresolved.

The first author intends to recognize *Sinoleontopodium* in his forthcoming treatment of the tribe Gnaphalieae in the *Flora of China*. It is therefore necessary for the only species of *Sinoleontopodium* to have a validly published name. The present paper validates the name *S. lingianum* under Article 45.1 (McNeill et al., 2006) by designating as the holotype a specimen from the gathering with female florets, cited in the original publication, and by direct reference to Chen's Latin description there. A specimen from the gathering with male florets is designated as a paratype. We ascribe both the name, *S. lingianum*, and its Latin description to the original author, Y. L. Chen, so that, under Article 46.2, the name must be

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attributed to that author. We intend that the authorship of this name should be cited simply as Y. L. Chen, or more precisely Y. L. Chen in Y. S. Chen & Q. E. Yang.

Sinoleontopodium lingianum Y. L. Chen in Y. S. Chen & Q. E. Yang, sp. nov. TYPE: China. Xizang (Tibet): Mainling Co., Daduka, near Namucuo, 4500 m, on glacial gravel, 26 July 1983 [♀], *Exped. Pl. Resource, Inst. Biol. Xizang 3373* (holotype, PE).

The validating Latin description for *Sinoleontopodium lingianum* by Y. L. Chen appeared in Acta Phytotax. Sin. 23: 458–459. 1985.

Habitat and distribution. *Sinoleontopodium lingianum* is only known from Mainling County, Xizang Autonomous Region (Tibet), China, growing on cliffs and glacial gravels at altitudes from 4500 to 4900 m.

IUCN Red List category. *Sinoleontopodium lingianum*, known from only two small populations from similar localities in Mainling County, should be categorized as a Critically Endangered species (CR), according to IUCN categories and criteria (IUCN, 2001).

Paratype. CHINA. **Xizang (Tibet):** Mainling County, Daduka, Namula, alt. 4600–4900 m, on cliff, 26 July 1983 [♂], *B. S. Li, Z. C. Ni & S. Z. Cheng 5852* (PE).

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Two New Species of *Pentagonia* (Rubiaceae, Hippotideae) from Colombia and Ecuador

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Abstract. Two new species of *Pentagonia* Bentham (Rubiaceae, Hippotideae) are described and illustrated. *Pentagonia tapacula* Cornejo is from the pluvial forests of Bajo Calima, Valle del Cauca Department, southwestern Colombia. This new species belongs to a species group of plants with entire leaves that have a tapering, subsessile base, and with a 5-lobed calyx, but differs mainly by its thicker coriaceous leaf blades, obovate stipules, and inflorescences with remarkably elongated and thick peduncles. The second new species is *P. clementinensis* Cornejo from the wet forests of western Ecuador. This is segregated from *P. involucrata* C. M. Taylor, which differs sharply by its leaf blades, floral bracts, fruits, and calyces.

Resumen. Se describen e ilustran dos nuevas especies de *Pentagonia* Bentham (Rubiaceae, Hippotideae). *Pentagonia tapacula* Cornejo es de los bosques pluviales del Bajo Calima, Departamento del Valle de Cauca, en el suroccidente Colombiano. Esta nueva especie pertenece al grupo de las *Pentagonia* de hojas enteras, de base gradualmente angosta, subsésil, con cáliz 5-lobado, de las que principalmente se diferencia por presentar hojas con gruesas láminas coriáceas, estípulas obovadas, e inflorescencias con pedúnculos distintivamente más gruesos y largos. La segunda nueva especie es *P. clementinensis* Cornejo de los bosques muy húmedos de la región occidental de Ecuador. Esta es segregada de *P. involucrata* C. M. Taylor, de la que difiere notoriamente en cuanto a sus hojas, brácteas florales, cálices y frutos.

Key words: Chocó, Colombia, Ecuador, Hippotideae, IUCN Red List, *Pentagonia*, Rubiaceae.

Pentagonia Bentham (Rubiaceae, Hippotideae) is a Neotropical genus of usually understory shrubs to treelets, often monocaul or sparsely branched, with interpetiolar stipules that are triangular in bud and usually caducous, and with usually large, entire or pinnate leaf blades. The lateral inflorescences are in subsessile to pedunculate cymes or cymose, bearing flowers with a spathaceous or 3- to 5-lobed calyx; the corollas are regular to zygomorphic with the tube somewhat curved, hypocrateriform to infundibuliform, greenish or white to cream, yellow, or red, with (4 to)5 lobes. The corollas are fibrous with the staminal filaments tomentose at and around their base and are mostly hummingbird pollinated. The fruits are berries, 2-locular, many seeded, ± thick walled, and often crowned by a ± persistent calyx. *Pentagonia* comprises ca. 34 species, all found from moist to pluvial, tropical to premontane and rarely to lower montane forests, ranging from 0 to 1600(to 1800) meters above sea level, from Guatemala to Peru and Brazil (Dwyer, 1980; Burger & Taylor, 1993; Taylor, 1995, 2001, 2002). In South America, this genus is represented by ca. 21 species (Andersson & Rova, 2004; Cornejo, 2006). During the revision of the South American species of *Pentagonia*, the following novelties were discovered.

1. **Pentagonia tapacula** Cornejo, sp. nov. TYPE: Colombia. Dept. Valle del Cauca: Bajo Calima, ca. 15 km N of Buenaventura, Cartón de Colombia concession, 3°56′N, 77°08′W, ca. 50 m, transition betw. tropical wet & pluvial forest, 18 Feb. 1983, *A. Gentry & A. Juncosa 40480* (holotype, MO 3210799 [fl.]; isotypes, MO 3104184, MO 3104185 [fl., fr.], COL 259809 not seen). Figure 1.

Species nova affinis *Pentagoniae subsessili* L. Andersson & Rova, a qua stipulis obovatis 3.5–5.5 cm latis, lamina foliari 48–80 cm lata, inflorescentia pedunculo robusto 3.5–7 cm × 5–15 mm insidente, bracteis basalibus conduplicatis 2–3.5 cm longis, corolla glabra, viridi vel albida atque fructu 2–2.8 × 2–2.7 cm differt.

Shrub or unbranched pachycaul tree, to 10 m tall; terminal stems subtetragonal, young shoots densely strigose. Stipules obovate, 5–9 × 3.5–5.5 cm, stiffly coriaceous, strongly keeled, finely veined longitudinally, densely short-sericeous to strigose outside, at apex acuminate, ca. 8 mm (due to the elongated costa); petioles 0.5–2.5 × 1–2 cm, densely strigose; leaf blades entire, drying thickly coriaceous, obovate to oblanceolate, 75–140 × 48–80 cm, at apex somewhat obtuse, tapering at base; midveins densely to sparsely strigose, short-pilose or glabrous, and the

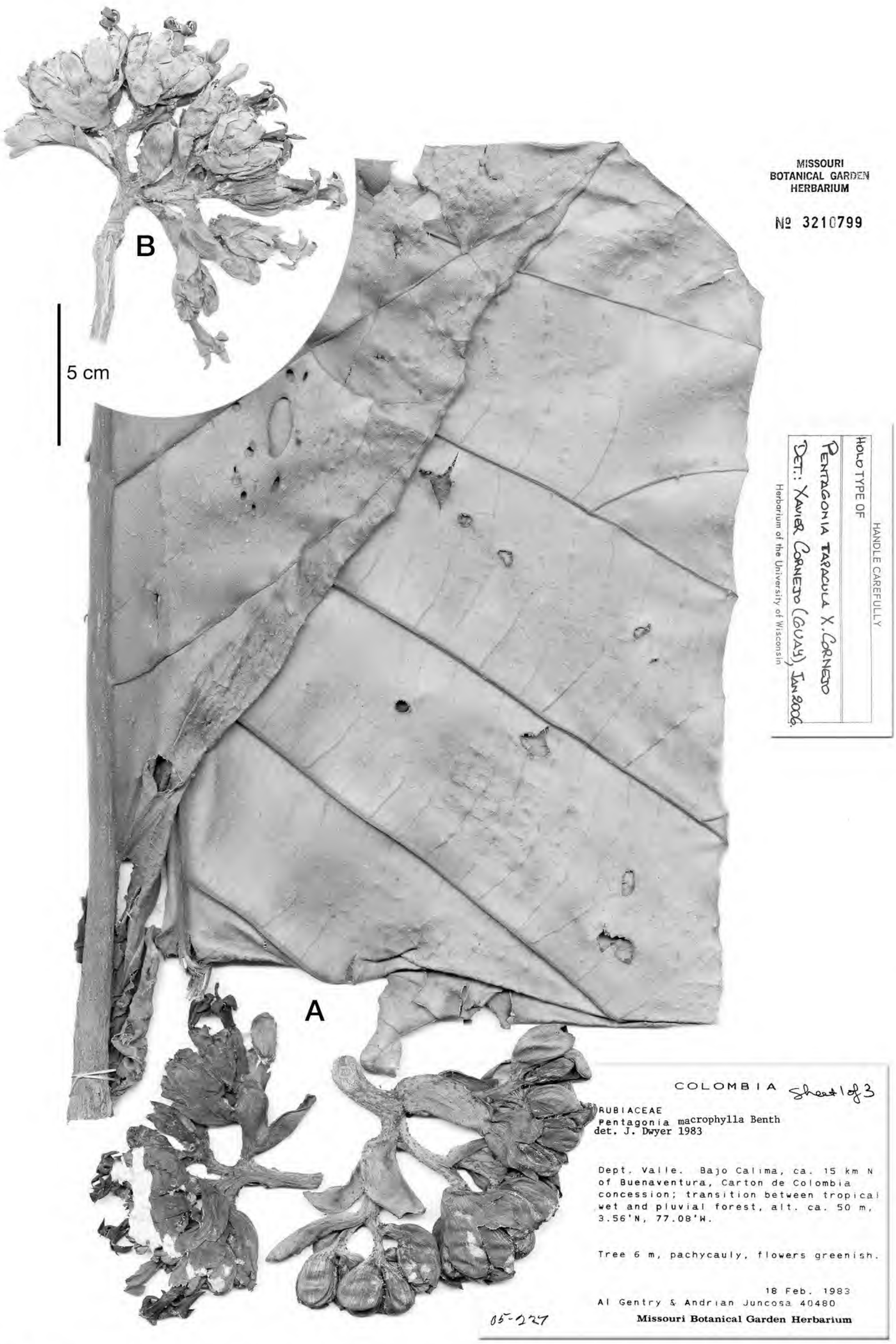

Figure 1. *Pentagonia tapacula* Cornejo. —A. Folded leaf blade and two separate inflorescences. —B. Inflorescence. A, from the holotype, *Gentry & Juncosa 40480* (MO 3210799); B, from the isotype, MO 3104185.

blades glabrescent or glabrous adaxially, veins tomentose to densely strigose, and the blades tomentose to sparsely strigose abaxially, margin usually strigose and glabrescent toward the apex, with 10 to 15 pairs of lateral veins. Inflorescences axillary, cymose, ca. 20- to 30-flowered, densely to sparsely strigose; peduncle stout, 3.5–7 cm × 5–15 mm, densely short-sericeous to strigose; basal

Table 1. Morphological comparison of *Pentagonia tapacula* and similar species.

	P. tapacula	*P. subsessilis*	*P. microcarpa*	*P. magnifica*	*P. wendlandii*
Leaf blade texture	coriaceous	papyraceous to thinly chartaceous	papyraceous to thinly chartaceous	papyraceous	chartaceous or subcoriaceous
Stipules	obovate, 5–9 × 3.5–5.5 cm	narrowly lanceolate, 3.5–8 × 1–2.5 cm	narrowly lanceolate, 2–3.5 × 0.7–1.2 cm	narrowly lanceolate, ca. 3–5 × 0.7–1.5 cm	lanceolate to ovate-oblong, 2.5–8.5 × 1–3 cm
Peduncle of the inflorescences	3.5–7 × 0.5–1.5 cm	0.5–2 × ca. 0.3–0.5 cm	0.5–1 × 0.3–0.5 cm	ca. 1 × 0.3 cm	0.5–2.5 × ca. 0.3–0.4 cm
Bracts	slightly obovate to oblong, 2–3.5 × 1–3 cm, yellow-green	oblong, 1–1.8 × 0.5–1.1 cm, reddish or green	oblong to lanceolate, 1–2 × 0.3–0.7 cm, pink-red or reddish green	narrowly lanceolate, ca. 0.5–1 × 0.1–0.3 cm, red	oblong, 0.6–2 × 0.3–0.7 cm, red
Calyx	green	red	pink-red	red	red to purplish red or brown-red
Corolla	greenish to white or cream, glabrous	pink to red, tomentose to tomentulose	pink-red to red, glabrous	red, hirtellous	yellow, glabrous to puberulent
Fruits	2–2.8 × 2–2.7 cm	ca. 3.5 × 3.5 cm	1–1.5 × 1–1.4 cm	ca. 1.2–1.5 × 1.2–1.5 cm	to 4.5 cm
Seeds	yellow	unknown	unknown	unknown	red

bracts conduplicate, obovate, 2–3.5 × 1–3 cm, coriaceous, yellow-green, densely short-sericeous to densely strigose and lenticellate outside; floral bracts slightly obovate to oblong, ca. 2–2.3 × 1–1.3 cm, yellow-green, ± chartaceous to foliaceous, with colleters in the basal 1/3 within, densely to sparsely strigose, glabrescent or glabrous without, margin ciliate, often with tufted fibers (from the vascular nerves reaching the outside of the margin); pedicels 2–6 mm, thick, somewhat complanate, densely strigose. Calyx regularly 5-lobed in the distal 1/3, ± chartaceous, green; hypanthium turbinate to cylindric, ca. 4 mm, tube 10–16 × 4–7 mm, both densely short-sericeous or strigose to glabrous without, with colleters arranged in longitudinal fields below the sinuses within, lobes ± equal, oblong, 5–9 × 5–7 mm, apex obtuse to rounded, glabrous without. Corolla hypocrateriform, greenish to white or cream, tube 20–25 × ca. 5 mm, glabrous without, lobes 5, lanceolate, ca. 8 × 3.5–5 mm, reflexed at anthesis, with abundant, tiny, flat to squamulose, light brown, subhyaline indumentum (apparently papillose when hydrated). Stamens 5, all filaments of similar length, 18–20 mm, attached 6–7 mm from the tube base, densely tomentose with flat yellowish hyaline hairs in the lower 1/3; anthers ca. 3 × 1 mm; style 18–20 mm, glabrous; stigma bilobate, ca. 3 mm. Infructescences with persistent bracts; fruits globose to globose-turbinate, 2–2.8 × 2–2.7 cm, ± truncate at the apex, fruit wall ca. 3 mm thick, brown to reddish brown, lenticellate, glabrescent or often densely strigose toward apex, crowned by a persistent calyx, with tube 1–8 mm; mature seeds ca. 5 mm, yellow.

Discussion. In its subsessile leaves with blades tapering at the base and its 5-lobed calyx, *Pentagonia tapacula* is similar to *P. subsessilis*, *P. microcarpa* L. Andersson & Rova, *P. magnifica* K. Krause, and *P. wendlandii* Hooker (Table 1). It differs from these species by the thicker coriaceous leaf blades; the wider, obovate, stiffly coriaceous stipules; and the inflorescences with remarkably longer and thicker peduncles. The new species also differs from *P. subsessilis* by its larger bracts, which are conduplicate at the base of the inflorescence, and its glabrous corolla greenish to white or cream outside, longer stamens, and smaller fruits. *Pentagonia tapacula* additionally differs from the Amazonian *P. microcarpa* by the yellow-green larger bracts and larger fruits (vs. fruits only to 1.5 cm). It resembles *P. wendlandii*, restricted to the lowland Caribbean rainforests of Costa Rica and Panama (Burger & Taylor, 1993), and apparently disjunct to the lowlands of Chocó Province in western Colombia (*Tuberquia et al. 490*, GB). However, *P. tapacula* differs from the latter by the tendency to have thicker petioles, yellow-green bracts, green calyx, greenish to white or cream corolla, and fruits globose to globose-turbinate with the apex ± truncate, containing yellow seeds. Finally, the new species also differs from *P. magnifica* by the green calyx; glabrous corolla, greenish to white or cream, with larger lobes; and distinctively larger bracts.

Habitat and distribution. *Pentagonia tapacula* is an endemic species of primary tropical lowland rainforests in western Colombia, collected from elevations 50–230 m. Physical parameters of its habitat include annual rainfall 7400 mm, an average relative humidity of 86%, and temperatures from 22°C–30°C (*J. van Rooden et al. 568*, MO). It grows in poor soils, noted as low in the nutrients P, Ca, K, Mg, Cu, B, Mn, Zn, and with a high percentage of saturation of Al (*Monsalve 384, 1327*, MO).

IUCN Red List category. *Pentagonia tapacula* is only known from five close localities within an area of less than 5000 km², which is under pressure of deforestation. The species is assigned a provisional IUCN conservation status of Endangered (EN B12c) (IUCN, 2001).

Vernacular name and uses. Tapacula (Colombian [slang] Spanish, in sched. *Monsalve 1327*, MO). This may refer to the fruit's use to treat diarrhea or cause constipation after consumption (Stella Sylva, Juan Granados-Tochoy, pers. comm.). The fruits at maturity are sweet and edible (*Monsalve 1327*).

Etymology. The specific epithet refers to its vernacular name. The epithet is considered as a noun in apposition, cf. Art. 23.1 and is supported by Art. 23.2 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006).

Phenology. *Pentagonia tapacula* has been collected with flowers and fruits from September to February.

Paratypes. COLOMBIA. **Valle del Cauca:** Mun. Buenaventura, Cartón de Colombia, 3°56′N, 77°10′W, *J. van Rooden, B. J. H. ter Welle & S. M. C. Topper 568* (MO); Bajo Calima, Pulpapel/Buenaventura, 3°55′N, 77°00′W, *M. Monsalve 384* (MO [2], NY); carr. La Gasolina, 25 Nov. 1986, *M. Monsalve 1327* (MO [2]); carr. Nacional, *M. Monsalve 3136* (MO [2]); carr. al mar, near Río Dagua, *E. L. Core 1510* (US).

2. Pentagonia clementinensis Cornejo, sp. nov. TYPE: Ecuador. Los Ríos: Hacienda Clementina, Cerro Samama, trail betw. Destacamento Pita & La Torre, betw. Ito [hito] 12 & 13, 1°39′S, 79°20′W, 600–700 m, 21 Sep. 1999 (fl., fr.), *C. Gustafsson & X. Cornejo 500* (holotype, GUAY; isotypes, GB [also photo, preserved material], S). Figure 2.

Species nova affinis *Pentagoniae involucratae* C. M. Taylor, a qua lamina foliari elliptica usque late elliptica majore (30–60 × 15–28 cm), bracteis floralibus minoribus et angustiorbus (5–15 × 3–7 mm), lobulis calycinis minoribus et angustiorbus (4–12 × 2–6 mm) atque fructibus in sicco globosis usque late ellipticis calyce persistente ad tubum sicut lobulos minores subaequales lenticellato coronatis differt.

Shrubs or trees, to 20 m tall and 30 cm DBH, branched, with open crown; terminal branches subtetragonal, strigulose, glabrescent or glabrous. Stipules narrowly lanceolate, 2.8–6 × 0.5–1.3 cm, chartaceous, rather smooth or finely veined longitudinally and ± densely strigulose to often strigose at the apex, glabrescent without, yellow or green, the tip usually minutely curved; petioles 3–6 cm × 2.4–5 mm, strigillose or glabrous; leaf blades entire, drying papyraceous to thinly chartaceous, elliptic to broadly elliptic or slightly obovate-elliptic, 30–60 × 15–28 cm, apex acute to obtuse, base cuneate, strigose to strigillose or glabrous (glabrescent with age) adaxially, densely strigose when very young, strigose to strigillose mainly on veins and glabrescent or glabrous at maturity abaxially, with 18 to 25 pairs of lateral veins. Inflorescences axillary, a pedunculate cyme, branched to 2nd order, ca. 4- to 12-flowered, glabrous; basal bracts unknown; peduncle 1.6–7 cm × 3–5 mm, flat to concave adaxially, green, glabrous; with 2 secondary axes (1 per side), 1–3.5 cm, both subtended by a pair of light green bracts, each bearing 1 to 3 flowers; lateral flowers with pedicels 5–18 × ca. 3 mm, somewhat complanate, central flowers subsessile; floral bracts 2 to 4, decussate, suborbicular to oblong or sublanceolate, 5–15 × 3–7 mm, light green, thinly chartaceous, apex rounded to obtuse or emarginate, with colleters at the inner base, glabrous on both sides. Calyx regularly 5-lobed in the distal 1/3, chartaceous to thinly chartaceous, greenish cream or red; hypanthium turbinate to obconic, 3–4 mm, occasionally with a single bract attached; tube 5–9 × 5–7 mm, both glabrous without, lobes slightly unequal, obovate to oblong, shorter to slightly longer than the tube, 4–12 × 2–6 mm, at apex obtuse to rounded, with colleters arranged in small groups around or at both sides of the sinuses, glabrous without and within, but margin sometimes ciliate. Corolla obconic to subcylindric, white with lobes pale pink at tip outside, tube 25–35 × 6–15 mm, shortly tomentose or golden-velutinous at the upper 1/2 and glabrous toward the base without, lobes 5, ovate to triangular, 6–14 × 3–8 mm, erect at anthesis (in La Clementina), glabrous or with scattered, whitish squamulose indumentum within. Stamens 5, filaments of unequal length, 12–18 mm long, all inserted ca. 4–5 mm from the tube base, densely golden-hirtellous or tomentose at the lower 1/3 to 1/2 and around their attachment to the corolla tube, anthers 3–4 × 0.6–1.1 mm; style ca. 15 mm, glabrous; stigma bilobate, ca. 1.5–2.7 mm. Infructescences with persistent bracts; fruits globose to broadly elliptic, 3–5(–7 cm,

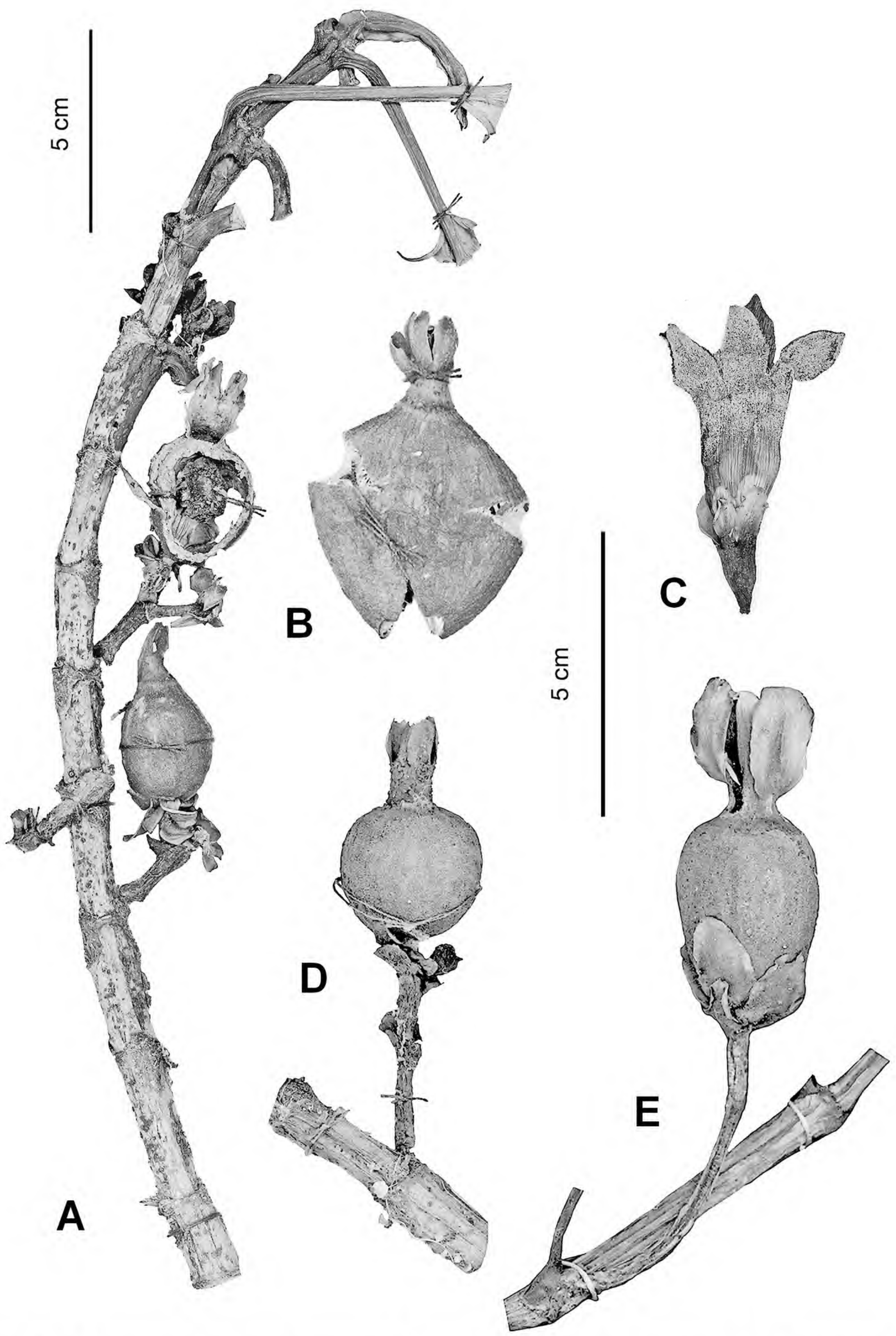

Figure 2. A–D. *Pentagonia clementinensis* Cornejo. —A. Terminal branch with infructescences. —B. Nearly mature fruit. —C. Flower at anthesis. —D. Infructescence. —E. *Pentagonia involucrata* C. M. Taylor. Infructescence. A, B, taken from the isotype, *Gustafsson & Cornejo 500* (S); C, taken from *Ståhl & Cornejo 5949* (S); D, from *Ståhl & Knudsen 1247* (S); E, from the isotype, *Aulestia & Aulestia 908* (GB).

Table 2. Morphological comparison of *Pentagonia clementinensis* and *P. involucrata*.

	P. clementinensis	*P. involucrata*
Leaf blades	elliptic to broadly elliptic or slightly obovate-elliptic, 30–60 × 15–28 cm	oblong-elliptic, 19–32 × 6–10 cm
Calyx lobes	4–12 × 2–6 mm	20–24 × 8–11 mm
Floral bracts	5–15 × 3–7 mm	13–22 × 9–12 mm
Fruits	globose to broadly elliptic, with persistent calyx tube ± as long as the calyx lobes	barrel-shaped, with persistent calyx tube 1/4 to 1/7 smaller than the calyx lobes

fide *Ortíz et al. 529*) × ca. 3–3.5 cm, rounded to obtuse at apex, fruit wall 1.5–7 mm thick, brown, richly lenticellate, glabrous, crowned by a persistent calyx, with tube ± as long as the lobes, both prominently lenticellate; mature seeds 5–7 × ca. 3 mm.

Discussion. In its petiolate leaf blades, the relatively long pedunculate inflorescences that become flexuous in fruit, the flowers surrounded by two to four persistent floral bracts, and the 5-lobed calyx with colleters in groups around the sinuses, *Pentagonia clementinensis* is related to *P. involucrata*, a lowland allopatric taxon endemic to northwestern Ecuador. This new species was previously included in the latter by Andersson and Rova (2004). However, *P. clementinensis* differs from *P. involucrata* by having larger and broader elliptic mature leaf blades, distinctively shorter and narrower calyx lobes, smaller and narrower floral bracts (Fig. 2D, E), and globose to broadly elliptic (dry) fruits with calyx tube approximately as long as the calyx lobes (Fig. 2B, D, E; Table 2).

Habitat and distribution. *Pentagonia clementinensis* is known from premontane to montane, wet to pluvial forests in western Ecuador between 600 and 1600 m. According to the literature, this is the highest altitudinal record for a species of this genus in South America (Burger & Taylor, 1993; Taylor, 1995, 2001, 2002; Andersson & Rova, 2004). Some populations of this new species are located at the upper part of the Reserva Indígena Awá, which belongs to the National System of Protected Areas of Ecuador (SNAP), and at Rancho Buitrón, in Pichincha Province. They are apparently disjunct to the lower wet forests in Cerro Samama (600–750 mm) at La Clementina, in Los Ríos Province.

According to herbaria records, *Pentagonia clementinensis* and *P. involucrata* appear to be allopatric. Even when both occur in the Reserva Indígena Awá, *P. clementinensis* is located higher on the western slopes of the Andes between 990 and 1600 m. *Pentagonia involucrata* occurs in lowlands between 250 and 500 m, ranging toward the west to the tropical evergreen and often hilly forests of the Cotacachi-Cayapas Reserve, which houses the largest (more than 200,000 ha.) and one of the best-conserved moist and wet forests of western Ecuador (Cornejo, pers. obs.). Both reserves contain the remaining forests of the province of Esmeraldas and therefore deserve higher efforts for conservation. *Pentagonia clementinensis* may also be expected in the pluvial forests of Chocó Department in southwestern Colombia.

Some morphological differences are noted among the disjunct populations of *Pentagonia clementinensis*. Those from Reserva Indígena Awá have a red calyx and the tendency to produce larger fruits (to 7 cm long) with a thicker fruit wall (3–7 mm). One of its vernacular names, "huevo de gallo," refers to the similarity of these larger fruits to a chicken's egg. In contrast, the disjunct population from La Clementina has a greenish cream calyx and somewhat smaller fruits (to ca. 4 cm) with a thinner fruit wall (1.5–3 mm).

IUCN Red List category. During the past four decades, the native populations of *Pentagonia clementinensis* have been fragmented due to extensive deforestation of the wet forests in western Ecuador (Dodson & Gentry, 1991; Cornejo, pers. obs.). The species is assigned an IUCN conservation status of Endangered (EN A1c) (IUCN, 2001).

Vernacular name and uses. Huevo de gallo (Spanish; in sched. *Ortíz et al. 529*, NY), Palo aguanoso (Spanish; in sched. *Beck et al. 3041*, NY). The fruits are edible.

Etymology. The specific epithet refers to the type locality La Clementina, which is the largest banana farm of Ecuador and which encompasses the best and perhaps the last forests of Los Ríos Province, sheltering many local and regional endemic plant taxa from western Ecuador (Cornejo, pers. obs.).

Phenology. *Pentagonia clementinensis* has been collected with flowers in April to June and September and with fruits in May, June, and September.

Paratypes. ECUADOR. **Prov. Los Ríos:** Hacienda Clementina, Cerro Samama, trail betw. Destacamento Pita & La Torre, 1°39′S, 79°20′W, *B. Ståhl & X. Cornejo 5898* (S); 25 May 1994, *B. Ståhl & J. Knudsen 1247* (GB, S), *B. Ståhl & X. Cornejo 5949* (S). **Prov. Pichincha:** Parr. Nanegalito, cuenca Río Pachijal, rancho Buitrón, 0°02′S, 78°43′W, *C. Cerón 38264* (QAP). **Prov. Carchi:** Awá Indigenous Territory, comm. Baboso, 0°55′N, 78°25′W, *A. Ortíz, E. Loachamín & W. Mayer 529* (NY); ca. 1 km W of house of Patrocinio Ortíz,

0°56′N, 78°25′W, *H. Beck, A. Ortíz, E. Loachamín & W. Mayer 3041* (NY); Tulcán Cantón, around encampment in Gualpi Chico area of Awá Reservation, NW & SE, 0°58′N, 78°16′W, *W. Hoover, A. Arguello, P. Gelpi & R. Lorentzen 3661* (GB, MO, QCA not seen); Río Blanco drainage above Chical, trib. of Río San Juan, ca. 12 km W of Maldonado, *A. Gentry & G. Schupp 26531* (MO, SEL).

Acknowledgments. This research was partially conducted at the Botany Department at the University of Wisconsin. The herbaria that I had the pleasure to visit are: GUAY, INB, MO, QAP, QCA, QCNE, SEL, and US. The curators and keepers of F, GB, MO, and S sent me their specimens of *Pentagonia* on loan, including the types of *Pentagonia involucrata*. Jacquelyn Kallunki and Néstor Pérez-Moliere (both NY) kindly provided a high-resolution scanned image of *Beck 3041*. Charlotte M. Taylor, Victoria C. Hollowell (both MO), and an anonymous reviewer made constructive comments on the manuscript. The figure of *P. tapacula* was scanned and designed by Kandis Elliot, artist in residence at the Botany Department, University of Wisconsin.

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Agrostopoa (Poaceae, Pooideae, Poeae, Poinae), a New Genus with Three Species from Colombia

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Abstract. *Agrostopoa* Davidse, Soreng & P. M. Peterson, a new genus endemic to the páramos of Colombia, is proposed. The genus includes two new species, *A. barclayae* Davidse, Soreng & P. M. Peterson and *A. woodii* Soreng, P. M. Peterson & Davidse, and a third species transferred from *Muhlenbergia* Schreber, *A. wallisii* (Mez) P. M. Peterson, Soreng & Davidse (lectotype designated here). A key for determining the species and illustrations of the three species are provided. *Agrostopoa* is placed in subfamily Pooideae because it has non-Kranz anatomy and lanceolate membranous lodicules, and in tribe Poeae where it differs from *Agrostis* L. by having carinate lemmas with a terminal awn or mucro, well-developed paleas, and peculiar synflorescences with recurved branches and fragile pedicels. It is classified near *Poa* L., but differs from that in its single-flowered spikelets that lack rachilla extensions and possess awned or mucronate lemmas.

Resumen. Se propone *Agrostopoa* Davidse, Soreng & P. M. Peterson como un género nuevo endémico de los páramos de Colombia. El genero incluye dos especies nuevas: *A. barclayae* Davidse, Soreng & P. M. Peterson y *A. woodii* Soreng, P. M. Peterson & Davidse; y las tres especies transferidos de *Muhlenbergia* Schreber: *A. wallisii* (Mez) P. M. Peterson, Soreng & Davidse (lectotipo designado aquí). Se presenta una clave de determinación y las ilustraciones de esas tres especies. *Agrostopoa* pertenese a la subfamilia Pooideae basado sobre la anatomía foliar de non-Kranz y el tipo de las lodiculas cuales son membranosas y lanceoladas, y a la tribu Poeae donde *Agrostopoa* se diferencia de *Agrostis* L. por tener las lemas carinadas con una arista o un mucron terminal, las paleas bien desarolladas y las inflorescencias peculiares con las ramas curvadas y los pedicelos frágiles. Segun la esquema de clasificación *Agrostopoa* es aproximada a *Poa* L., pero se diferencia de ése genero por tener las espiguillas con una sola flor que carecen la extensión de rachilla, y tienen las lemas aristadas o mucronadas.

Key words: *Agrostopoa*, Colombia, IUCN Red List, Poaceae, Poeae, Poinae, Pooideae, Sierra Nevada del Cocuy, Sierra Nevada de Santa Marta.

A perennial grass collected in 1959 by Barclay and Juajibioy on the isolated Sierra Santa Marta massif in northern Colombia has remained unnamed until now. Reexamination of this collection convinced us this collection represents an unknown species in subfamily Pooideae Bentham, tribe Poeae R. Brown. Our search also indicated that a very similar annual species had been previously described by Mez (1921) as *Muhlenbergia wallisii* Mez, a genus placed in subfamily Chloridoideae Kunth ex Beilschmied, subtribe Muhlenbergiinae Pilger (Peterson et al., 2001 [*M. wallisii* was intentionally excluded from this Chloridoideae volume of the *Catalogue of New World Grasses*], 2007). While inventorying species of *Muhlenbergia* Schreber from South America in 1989, PMP recognized that the type collected by G. Wallis (*M. wallisii*) was not a chloridoid grass, but a member of the Pooideae. Despite the efforts of agrostologists to assign this collection to a current genus in the intervening years, the mystery remained. After the initial description of *M. wallisii*, no further mention has been made of this species in the grass literature, as far as we are aware, until Soreng et al. (2003: 454) reevaluated the US isotype fragment and noted that it represented an "unknown *Deyeuxia* or Pooideae."

The reappearance of the *H. G. Barclay & P. Juajibioy 7079* specimen from the Sierra Nevada de Santa Marta gave us more material to study the annual species, enabling us to reclassify this species into the correct subfamily, and now we provide a new combination in a new genus, *Agrostopoa* Davidse, Soreng & P. M. Peterson. In addition, we also describe two new species of *Agrostopoa*, one based on another

Barclay & Juajibioy collection from the headwaters of the Río Sevilla, Sierra Nevada de Santa Marta, and the other based on a *J. R. I. Wood* collection from about 500 km south-southeastward in the Sierra Nevada del Cocuy in Colombia.

Agrostopoa Davidse, Soreng & P. M. Peterson, gen. nov. TYPE: *Agrostopoa wallisii* (Mez) P. M. Peterson, Davidse & Soreng.

Genus novum ad tribum Poeas pertinens quod ab *Agrostide* L. lemmate carinato in mucronem vel aristam non geniculatam terminalem desinente atque palea subchartacea et chlorophyllosa lemma aequante manifeste bicarinata marginibus spatium inter carinas non excedentibus recedit; a *Poa* L. spiculis sine racheolae extensione flosculum solitarium gerentibus atque lemmate aristato vel mucronato recedit.

Annuals or perennials, tufted or sometimes rooting at the lower culm nodes, branching primarily intravaginal; *culms* 7–29 cm, terete, slender, hollow, glabrous, smooth; *nodes* 2 to 6 or more, 0 to 3 nodes exposed above. *Upper sheaths* loose, smooth, margins closed at the base for 1–3 mm or up to 1/4 the length; *basal sheaths* herbaceous, papery, or becoming fibrous; collars without auricles; *ligules* 0.5–3.5 mm, hyaline, clear or slightly brownish, abaxially smooth, glabrous, apices entire to sparingly shallowly lacerate or irregularly deeply lacerate; *blades* 0.8–5 cm, to 1.5 mm wide, thin, folded with flat or slightly involute margins, the uppermost 0.5–1 cm, apices indistinctly to distinctly naviculate, slightly scabrous. *Synflorescences* 1–4 cm with 5 to 20 spikelets, paniculate, axis erect or arching, smooth, with 2 to 5 nodes; *branches* 1 to 4(to 5) per node, spreading, sinuous, slender, fragile, smooth, longest branches 0.4–1.6 cm with 1 to 7 spikelets; *pedicels* smooth, proximally capillary, recurved, fragile (breaking near base), distally expanded for 0.2–5 mm below the spikelet attachment. *Spikelets* 2.4–5.6 mm (excluding awns), 1-flowered, laterally compressed, nodding, without a rachilla extension, disarticulating above the glumes; *glumes* 2, unequal to equal in length, thinly chartaceous, 1- to 3-nerved, keel smooth or keel and margins slightly scabrous apically, margins hyaline, narrow, spreading and exposing the floret; *lower glumes* 2–5.6 mm, 1-nerved; *upper glumes* 2.4–5.6 mm, 1- to 3-nerved; *lemmas* 2.1–4.5 mm, slightly shorter to slightly longer than the glumes, laterally compressed, 5-nerved, glabrous, surfaces mostly smooth, thinly chartaceous, keeled, keels finely scabrous in the distal 1/3–1/2; *apices* mucronate (< 0.7 mm) or awned from between 2, delicate, slightly scabrous, lateral lobes to 0.2 mm, or terminally awned, mucros and awns extended only as a vein, densely and finely scabrous; *awns* 2–5.2 mm, straight, or slightly sinuous, twisted; *calluses* glabrous, smooth, indistinct; *paleas* subequal to equal to the lemma in length, hyaline to thinly chartaceous, chlorophyllous, keels 2, smooth or slightly scabrous with distal hooks, the margins about as wide as the inter-keel region, 0.2–0.25 mm wide. *Flowers* bisexual; *lodicules* 0.3–0.7 mm, 2, lanceolate, entire; *stamens* 3, rarely 2, anthers 1.6–2.7 mm, filaments attached near the middle of the anther; *ovaries* glabrous, styles terminal, stigmas densely plumose, white, bearing branches to or near the base; *caryopses* 1.2–2 mm, fusiform, slightly laterally compressed, ventrally shallowly sulcate, firm, slightly translucent, light brown; *hilum* basal, punctiform; *embryo* 1/5–1/3 the length of the grain. *Chromosome* number unknown.

Leaf anatomy. In cross section, the blades are thin with unspecialized mesophyll and widely spaced vascular bundles indicating C_3 metabolism. Microhairs are absent.

Distribution. All three species currently described in *Agrostopoa* are endemic to páramos of northern Colombia, from 3450 to 4500 m elevation.

Etymology. We combine the generic names of *Agrostis* and *Poa* to represent a new genus that is somewhat morphologically intermediate between these two genera.

Discussion. *Agrostopoa* differs from *Agrostis* by having carinate lemmas that are mucronate or awned with terminal non-geniculate awns and by having thinly chartaceous, chlorophyllous paleas that are as long as the lemmas with distinct keels where the distance between the two nerves is equal to or broader than the distance from either nerve to the margin. *Agrostopoa* differs from *Poa* by having spikelets with a single floret without a rachilla extension, and by having awned or mucronate lemmas.

The only species of *Agrostopoa* previously described was named *Muhlenbergia wallisii* (≡ *Agrostopoa wallisii*) by Mez (1921). Because *A. wallisii* does not have Kranz anatomy and bicellular microhairs are lacking, it is definitely misplaced as a member of subfamily Chloridoideae (Peterson et al., 2001, 2007). In addition to possessing C_3 metabolism, the lodicules of *Agrostopoa* are thin and lanceolate, characteristics that indicate a relationship with subfamily Pooideae rather than Chloridoideae.

Agrostopoa seems most allied to members of tribe Poeae s.l., subtribe Poinae (Soreng et al., 2003, 2007, 2008), where the following genera also have single-flowered spikelets: *Aniselytron* Merrill, *Apera* Adanson, *Arctagrostis* Grisebach, *Libyella* Pampanini, and *Tovarochloa* T. D. Macfarland & But. Traditionally, subtribe Agrostidinae Fries has included many genera

with single-flowered spikelets, but that characteristic is highly homoplastic in tribe Poeae sensu Soreng et al. (2003; cf. Soreng et al., 2007). Based on the following five major suites of characters, we are placing *Agrostopoa* in subtribe Poinae rather than Agrostidinae: (1) the upper culm sheaths are closed up to 1/4 their length, common in Poinae, rare or absent in Agrostidinae; (2) the palea keels are well separated, with the palea margins about as broad as the inter-keel gap, whereas in Agrostidinae the margins are commonly wider than the narrow inter-keel gap (or invagination, if detectable when keels are absent); (3) the paleas are membranous and chlorophyllous, whereas Agrostidinae paleas are typically hyaline throughout except for the nerves of the keel (when present); (4) the awns are terminal and not geniculate, and the awns themselves are evenly scabrous along their length, whereas in the Agrostidinae the awns are typically dorsal and geniculate and the vestiture may vary along the length of the awn (exceptions are the following genera that have terminal or subterminal awns: *Ancistragrostis* S. T. Blake, *Simplicia* Kirk, *Echinopogon* P. Beauvois, and *Dichelachne* Endlicher); and (5) the lemmas and calluses are totally glabrous and smooth except for hooks on the upper half on the keel and apex near the awn (*Agrostis* and relatives typically have some lines of minute hairs along the base of the marginal nerves, and there are usually hooks and also sometimes hairs on the lemma surfaces). Without additional analyses, we are not able to suggest what genera within the Poinae might be most closely related to *Agrostopoa*.

Agrostopoa species resemble elements of the Old World *Colpodium* Trinius complex (Alexeev, 1980; Alexeev & Tzvelev, 1981; Hedberg & Hedberg, 1994) that have single-flowered spikelets with glumes approximately equaling the lemmas and lack or have only vestigial rachilla extensions (i.e., *Colpodium* s. str. [sections *Colpodium* and *Keniochloa* (Melderis) E. B. Alexeev] and *Paracolpodium* (Tzvelev) Tzvelev sections *Paracolpodium* and *Tzvelevia* E. B. Alexeev). Species of *Agrostopoa* differ from all of these by the glabrous lemmas that are scabrous in the upper part (vs. pubescent in part and smooth throughout) and have awns or mucros, and by having hooks along the palea keels. From *Colpodium* they also differ in having 5-veined lemmas, and from *Paracolpodium* they differ in lacking rhizomes. *Agrostopoa* panicles are reminiscent of the racemose panicles with pendulous spikelets found in *P. wallichii* (Hooker f. ex Stapf) E. B. Alexeev. Preliminary molecular analyses by Gillespie et al. (2008) have shown *Colpodium* and *Zingeria* P. A. Smirnow to group together with *Milium* L., slightly apart from other elements of subtribes Puccinelliinae Soreng & J. I. Davis and Poinae, and for *Paracolpodium* to align within Puccinelliinae with *Catabrosa* P. Beauvois, *Catabrosella* (Tzvelev) Tzvelev, and *Hyalopoa* (Tzvelev) Tzvelev. However, unlike *Agrostopoa*, none of the other genera listed above or other Puccinelliinae have awns, whereas some genera of Poinae do. A possible relationship of *Agrostopoa* to genera of subtribe Cinninae Caruel also needs to be explored, as newer DNA evidence suggests that Cinninae genera may belong within Poinae (Gillespie et al., 2008). Cinninae genera have single-flowered spikelets, but, among other differences from *Agrostopoa*, their spikelets disarticulate at the base of the glumes, and their panicles are otherwise unspecialized.

KEY TO THE SPECIES OF *AGROSTOPOA*

1a. Plants annual; lower glumes (2–)2.3–2.6 mm; upper glumes (2–)2.4–3.9 mm. . . . . .1. *A. wallisii*
1b. Plants perennial; lower glumes (2.8–)3.4–5.6 mm; upper glumes (3.2–)4–5.6 mm.
  2a. Lemmas awned, the awns 2–5.2 mm; basal sheaths papery; plants loosely tufted; culm nodes 3 to 10, upper 1 or several nodes exserted from the basal tuft of leaves; major roots to 0.25 mm diam.; lower glumes (2.8–)3.4–4.4 mm; upper glumes (3.2–)4–4.4 mm . . . . . .2. *A. barclayae*
  2b. Lemmas mucronate, the mucros to 0.6 mm; basal sheaths becoming fibrous; plants densely tufted; culm nodes 2 or 3, hidden in the basal tuft of leaves; major roots to 0.4 mm diam.; lower glumes 4.4–5.6 mm; upper glumes 4.7–5.6 mm. . . . . .3. *A. woodii*

1. Agrostopoa wallisii (Mez) P. M. Peterson, Soreng & Davidse, comb. nov. Basionym: *Muhlenbergia wallisii* Mez, Repert. Spec. Nov. Regni Veg. 17(13–18): 214. 1921. TYPE: Colombia. Magdalena: Sierra Nevada de Santa Marta, *G. Wallis s.n.* (lectotype, designated here, US 90978 ex B; isotype, US 90979). Figure 1.

Annuals, branching frequently from the lower nodes; *major roots* ca. 0.20 mm diam.; *culms* 7–15 cm, slender, erect, smooth, glabrous; *internodes* more than 6, except the 2 lowermost, all elongated, without adventitious roots. *Leaves* mostly cauline; *sheaths* herbaceous not becoming fibrous or papery, with the margins free to within 1–2.5 mm of the base and overlapping for most of its length, loose (lightly inflated), smooth; *ligules* 0.8–3.5 mm, triangular, hyaline except at the base, acute, smooth, clear, upper margin entire or sparingly lacerated; *blades* 0.8–2.5 cm, ca. 0.3 mm wide, folded or slightly involute, twisted in senescent blades, thin, surfaces and margins smooth, apex indistinctly narrowly naviculate, smooth (faintly slightly roughened with incipient hooks). *Panicles* 1–3.5 cm, with 5 to 15

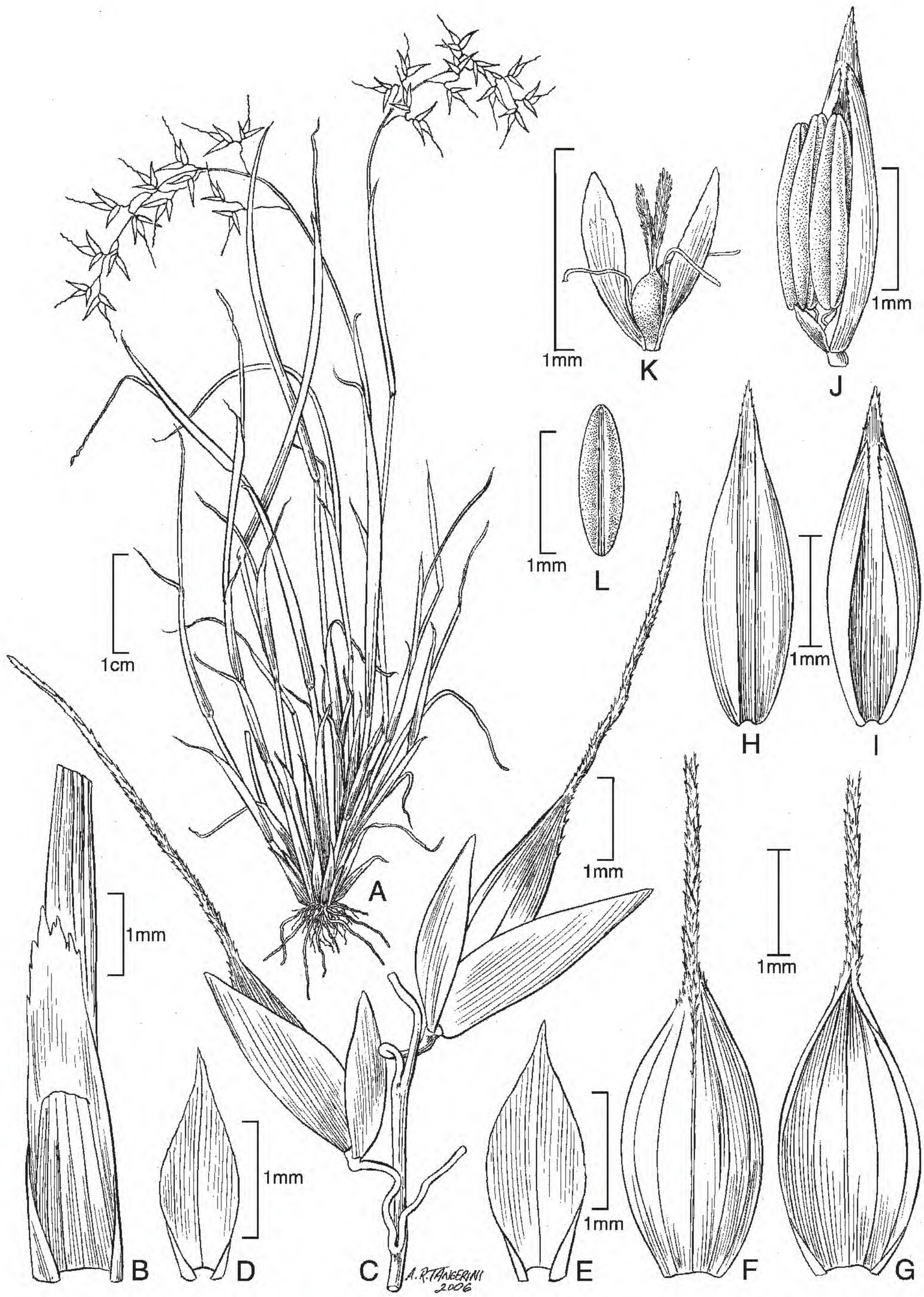

Figure 1. *Agrostopoa wallisii* (Mez) P. M. Peterson, Soreng & Davidse. —A. Plant habit. —B. Sheath, ligule, and blade. —C. Detail of panicle. —D. Lower glume. —E. Upper glume. —F. Lemma, dorsal view. —G. Lemma, ventral view. —H. Palea, dorsal view. —I. Palea, ventral view. —J. Lodicules and stamens enclosed in palea. —K. Lodicules and pistil. —L. Caryopsis. Drawn from *H. G. Barclay & P. Juajibioy 7079* (MO, US).

spikelets, the main axis erect, included in the upper cm with 3 to 5 nodes; *lateral branches* 1 to 4(to 5) at the lowest node, spreading, slender, smooth; *longest branches* up to 1.5 cm with up to 7 spikelets; *pedicels* 0.4–3 mm, with distal 0.2–0.8 mm expanded to the tip. *Spikelets* 2.4–3.9 mm, excluding the awns, mostly longer than the pedicels; *glumes* 0.4–0.5 mm wide in side view, 1-nerved, laterally compressed, (colors not determinable from the senescent material available), margins narrowly hyaline from near the base, smooth, apex acuminate to subaristate, keel smooth; *lower glumes* (2–)2.3–2.6 mm, usually distinctly shorter than the upper glume and the floret; *upper glumes* (2–) 2.4–3.9 mm, slightly longer or as long as the floret; *florets* 2.4–3 mm; lemmas 2.1–3 mm, laterally compressed, terminally awned, 5-nerved with the lateral and marginal nerves inconspicuous, keeled, keel with fine hooks in the distal 1/8–1/4, sides smooth, green to purple, margins involute at maturity, proximally narrowly hyaline in the distal 1/2, suffused with purple then clear to the edge; *awns* 2.5–5.2 mm, arising from the apex, entered by the central nerve only, hygroscopic, usually slightly sinuous near the middle, loosely twisted in the lower 1/2, minutely scabrous throughout; *callus* not well differentiated, blunt, smooth, glabrous; *paleas* about as long as the lemma or slightly shorter, acute, hyaline throughout or the keels slightly thicker and chlorophyllous, weakly 2-keeled, keels ca. 0.2 mm apart, smooth, margins ca. 0.2 mm wide; *lodicules* ca. 0.3 mm, minute; *anthers* 1.6–2.1 mm; *caryopses* ca. 1.5 mm, ventrally straight and dorsally curved, dark honey brown at maturity.

Distribution and habitat. *Agrostopoa wallisii* is endemic to the high-elevation páramos of the Sierra Nevada de Santa Marta. Specimens have been collected on rock outcrops and on dry soils near the headwaters of the Río Ancho at 3500 m in Colombia.

IUCN Red List category. *Agrostopoa wallisii* clearly falls within the Data Deficient (DD) category as defined by the IUCN (2001). We have inadequate information to assess the status of this species, since we do not have data regarding its abundance or the extent of its distribution.

Discussion. A lectotype at US was selected because the holotype at B was destroyed and we do not know if other original material exists.

Additional specimen examined. COLOMBIA. **La Guajira** [as Depto. Magdalena on original label]: Sierra Nevada de Santa Marta, alrededores de cabeceras de Río Ancho, Páramo de Macotama, 10°54′55″N, 73°30′50″W, 3500 m, 18 Feb. 1959, *H. G. Barclay & P. Juajibioy 7079* (COL not seen, MO 2778513, US 2434347).

2. Agrostopoa barclayae Davidse, Soreng & P. M. Peterson, sp. nov. TYPE: Colombia. Magdalena: Sierra Nevada de Santa Marta, alrededores de cabeceras de Río Sevilla, 3490 m, 20 Jan. 1959, *H. G. Barclay & P. Juajibioy 6567* (holotype, MO 5114991; isotypes, COL, US 2434406, US). Figure 2.

Ab *Agrostopoa wallisii* (Mez) P. M. Peterson, Davidse & Soreng habitu perenni, invaginationibus basalibus chartaceis, glumis inferioribus (2.8–)3.4–4.4 mm longis atque superioribus (3.2–)4–4.4 mm longis recedit.

Perennials, loosely tufted with spreading culms, sometimes rooting at the lower nodes; *major roots* ca. 0.25 mm diam.; *culms* 11–29 cm, erect to decumbent at the base in longer culms, smooth; *internodes* 3 to 10, elongated, longer culms with adventitious roots at the lower nodes. *Leaves* in basal clusters or in elongated culms in one to several clusters from the base of branches, originating from the lower 1/3 of the culm; *basal sheaths* papery, with the margins free to within 1–3 mm of the base and overlapping for most of their length, smooth; *ligules* 1–3.1(–3.3) mm, membranous, deeply to shallowly and irregularly lacerate, acute, abaxially smooth, clear or brownish; *blades* 1.5–5 cm, 0.3–0.5 mm wide, to 0.9 mm wide when flattened, folded or slightly involute, thin, margins smooth, apex indistinctly naviculate, faintly scabrous. *Panicles* 2–4 cm with 5 to 20(to 30) spikelets, main axis erect with 2 to 4 nodes, smooth; *lateral branches* with 1 to 3 spikelets, spreading, slender, smooth; *pedicels* 0.7–4 mm, with distal 0.2–0.8 mm expanded to the tip. *Spikelets* (3.5–)4–4.5 mm excluding the awns; *glumes* 0.2–0.3 mm wide in side view, 1-nerved to faintly 3-nerved, laterally compressed, dorsally green to purple, laterally purple, margins hyaline from near the base, apex acute, keel and margins apically weakly scabrous; *lower glumes* (2.8–)3.4–4.4 mm, as long as or slightly shorter than the floret; *upper glumes* (3.2–)4–4.4 mm, as long as or slightly longer than the floret; *florets* 4–4.5 mm; *lemma* keel with fine hooks in distal 1/2, sides inconspicuously papillate, terminally awned, 5-nerved with the marginal nerves inconspicuous, smooth, glabrous, green to purple, margins involute proximally, narrowly hyaline in distal 1/2, suffused with purple then clear to the edge, with sparse hooks toward the apex; apex acute, sometimes with delicate, hyaline lobes ca. 0.2 mm; *awns* 2–5.2 mm, arising from the apex or between the lobes, entered by central nerve only, straight, slightly bent, or sinuous, but never geniculate and not or only slightly twisted at the base, minutely scabrous throughout; *callus* not well differentiated, blunt, smooth, glabrous; *paleas* about as long as the lemma, keels ca. 0.25 mm apart, margins 0.25 mm wide,

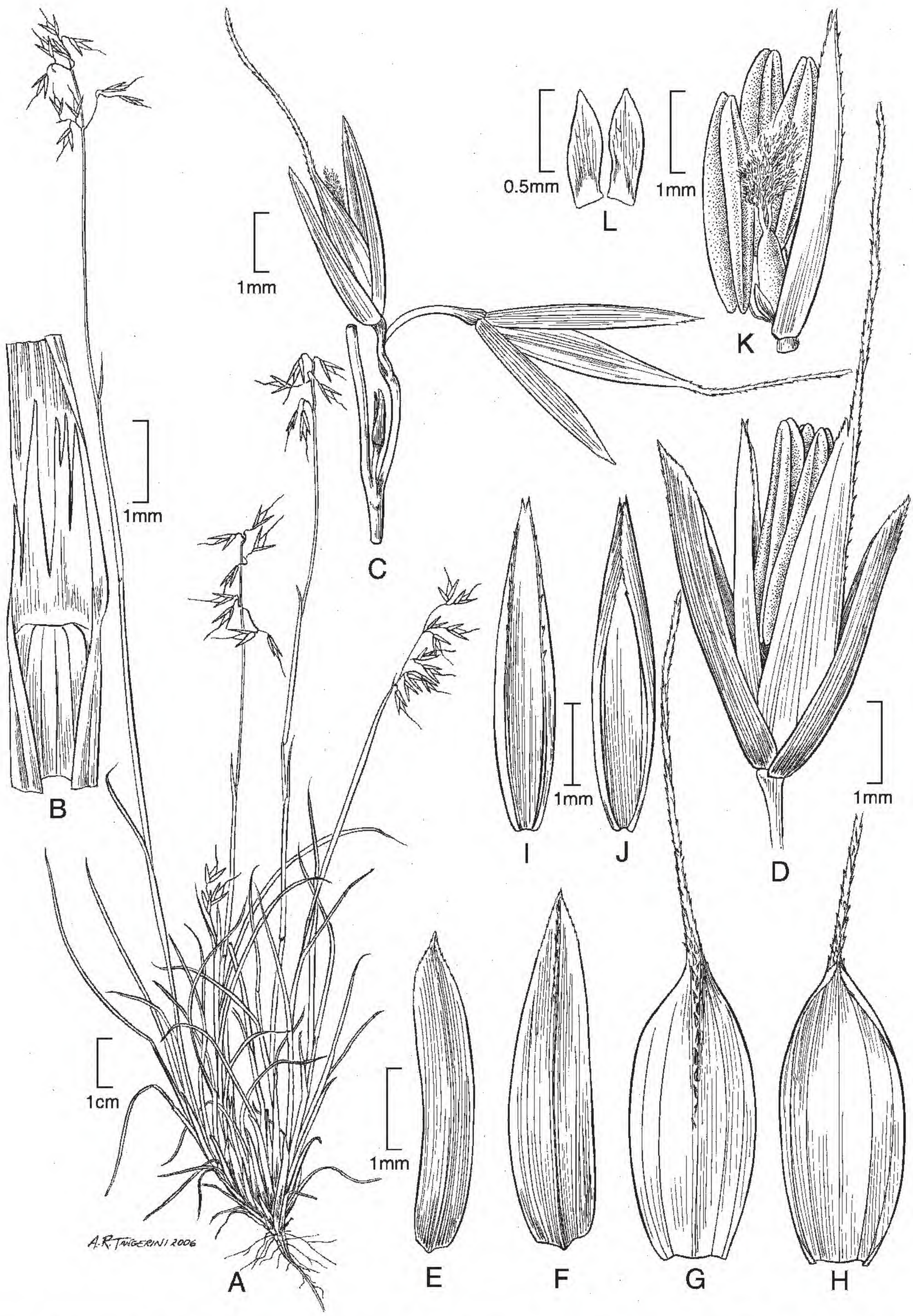

Figure 2. *Agrostopoa barclayae* Davidse, Soreng & P. M. Peterson. —A. Plant habit. —B. Sheath, ligule, and blade. —C. Detail of panicle. —D. Spikelet. —E. Lower glume. —F. Upper glume. —G. Lemma, dorsal view. —H. Lemma, ventral view. —I. Palea, dorsal view. —J. Palea, ventral view. —K. Lodicules, pistil, and stamens enclosed in palea. —L. Lodicules. Drawn from the isotype, *H. G. Barclay & P. Juajibioy 6567* (US).

keels distally and apex with few hooks; *lodicules* ca. 0.5 mm, flat, nerveless, asymmetrically lanceolate with an acute tip; *anthers* 2.1–2.7 mm, caryopsis fusiform, light brown, slightly translucent (suggesting lipid), ventrally sulcate.

Distribution and habitat. *Agrostopoa barclayae* is known only from the type locality near the headwaters of the Río Sevilla in the Sierra Nevada de Santa Marta, Colombia, where it was found growing among large rocks in a deep draw bounded by rock outcrops on west-facing slopes.

IUCN Red List category. *Agrostopoa barclayae* clearly falls within the Data Deficient (DD) category as defined by the IUCN (2001). We have inadequate information to assess the status of this species, since we do not have data regarding its abundance or the extent of its distribution.

Etymology. The epithet honors Harriet G. Barclay, a former professor of botany at the University of Tulsa (1929–1942), long-time botanist of the Rocky Mountain Biological Laboratory, and explorer of the Sierra Nevada de Santa Marta, who collected the type.

3. Agrostopoa woodii Soreng, P. M. Peterson & Davidse, sp. nov. TYPE: Colombia. Boyacá: Sierra Nevada del Cocuy, Boquerón cf. Cusiri, 4450 m, 31 Dec. 1985, *J. R. I. Wood 5268* (holotype, US 3481074; isotype, K). Figure 3.

Ab *Agrostopoa wallisii* (Mez) P. M. Peterson, Davidse & Soreng habitu perenni, invaginationibus basalibus fibrosis, glumis inferioribus 4.4–5.6 mm longis, superioribus 4.7–5.6 mm longis atque lemmatibus mucronatis (non aristatis) mucrone 0.2–0.6 mm longo recedit.

Perennials, completely glabrous, densly caespitose with spreading culms, sometimes rooting at the lower nodes; *major roots* ca. 0.4 mm diam.; *culms* 15–20 cm, erect to decumbent at the base in longer culms, smooth; *nodes* 2 or 3; *internodes* usually 2 or 3, hidden in the basal tuft, longer culms with adventitious roots at the lower nodes. *Leaves* in basal clusters or in elongated culms in one to several clusters from the base with branches originating from the lower 1/3 of the culm; *sheaths* becoming distinctly fibrous in age, uppermost ca. 4 cm, with the margins fused ca. 1/4 the length and overlapping on the upper part, smooth; *ligules* 0.5–2.5 mm, membranous, deeply, irregularly lacerate, acute, abaxially smooth, clear or brownish; *blades* 1.5–4.5 cm, 0.5–0.8 mm wide, up to 1.5 mm wide when flattened, flat or folded or slightly involute on the margins, thin, surfaces and margins smooth, apex abruptly distinctly naviculate, smooth. *Panicles* 2–3 cm, with 8 to 11 spikelets, barely exserted, main axis erect, with 3 to 5 nodes, smooth; *lateral branches* 1 to 3 per node, 0.4–0.6(–1) cm with solitary spikelets, spreading, slender, smooth, capillary, fragile, recurved at the base, with distal 3–5 mm gradually thickened to the tip. *Spikelets* 4.5–5.6 mm excluding the awns; *glumes* 0.2–0.3 mm wide in side view, 1- to 3-nerved, laterally compressed, dorsally green to purple, laterally purple, margins hyaline from near the base, apex acute, keel and margins apically weakly scabrous; *lower glumes* 4.4–5.6 mm, slightly shorter to slightly longer than the floret; *upper glumes* 4.7–5.6 mm, slightly longer than the floret; *florets* 3.7–4.5 mm; lemma keel with fine hooks in distal 1/2, sides inconspicuously papillate, terminally mucronate, 5-nerved with the marginal nerves inconspicuous, surface smooth, glabrous, green to purple, margins involute proximally, hyaline in distal 1/2, suffused with purple then clear to the edge, with sparse hooks toward the apex; apex acute or sometimes with 2 delicate, hyaline lobes ca. 0.1 mm; *mucros* 0.2–0.6 mm, arising from apex or between lobes, entered by central nerve only, straight, minutely scabrous throughout; *callus* not well differentiated, blunt, smooth, glabrous; *paleas* slightly shorter than the lemma, keels ca. 0.25 mm apart, margins 0.25 mm wide, keel apex with few to several hooks; *lodicules* ca. 0.7 mm, flat, nerveless, broadly lanceolate with a slightly irregularly lobed tip; *stamens* 3, rarely 2; *anthers* 1.7–2.2 mm; *caryopsis* ca. 2 mm, fusiform, light brown, firm, slightly translucent (suggesting lipid), ventrally sulcate.

Distribution and habitat. *Agrostopoa woodii* is known only from the Colombian type locality of Boquerón cf. Cusiri (Cusiri Pass) in the Sierra Nevada del Cocuy, ca. 100–130 km southeast of Bucaramanga, where it was found growing on bare gravel banks beside a stream in a páramo at 4450 m.

IUCN Red List category. *Agrostopoa woodii* clearly falls within the Data Deficient (DD) category as defined by the IUCN (2001). We have inadequate information to assess the status of this species, since we do not have data regarding its abundance or the extent of its distribution.

Etymology. The epithet honors the type collector J. R. I. Wood (1944–), a botanist at Oxford University who specializes in Acanthaceae and Lamiaceae, and who has been on many South American collecting expeditions.

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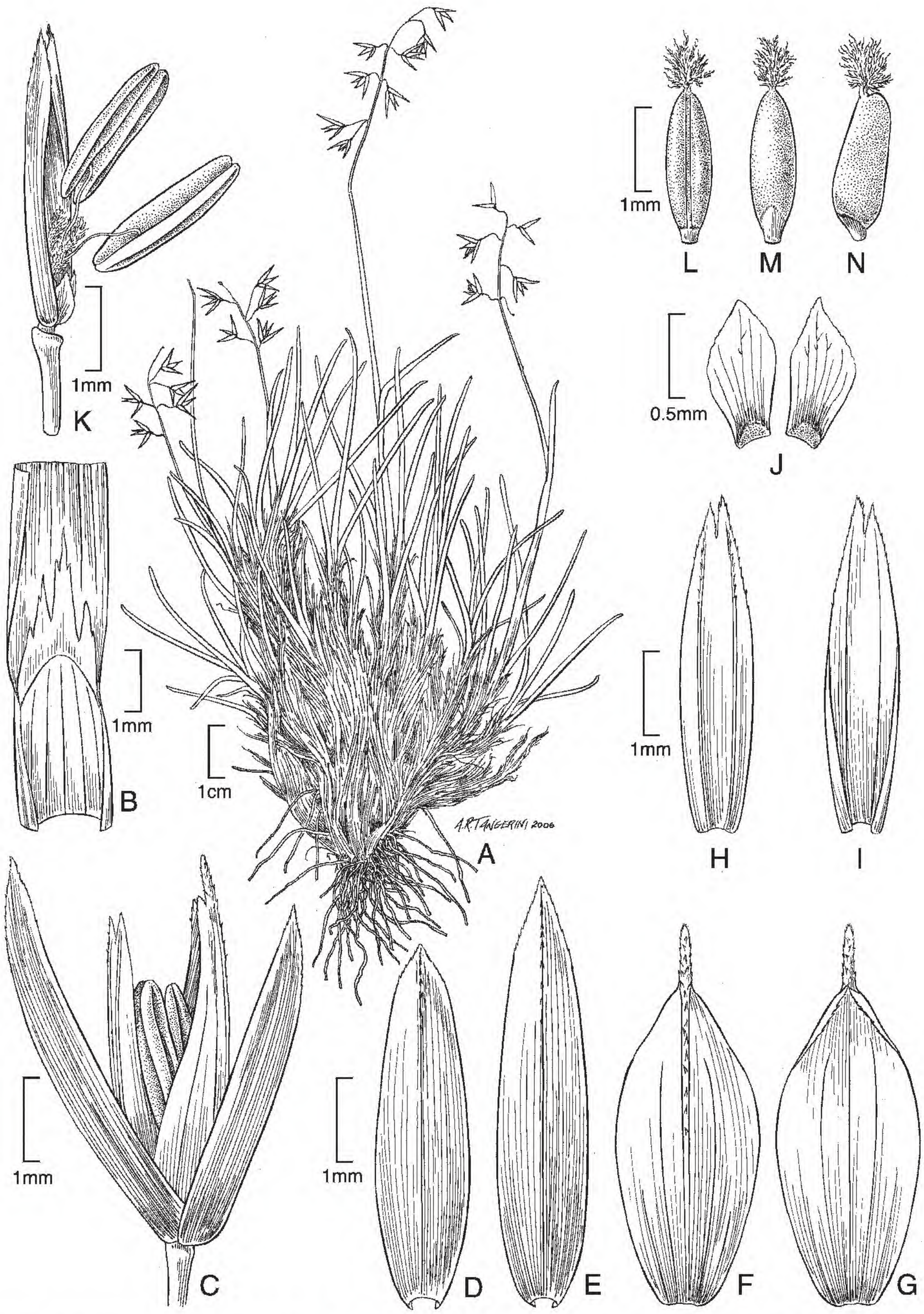

Figure 3. *Agrostopoa woodii* Soreng, P. M. Peterson & Davidse. —A. Plant habit. —B. Sheath, ligule, and blade. —C. Spikelet. —D. Lower glume. —E. Upper glume. —F. Lemma, dorsal view. —G. Lemma, ventral view. —H. Palea, dorsal view. —I. Palea, ventral view. —J. Lodicules. —K. Lodicules, pistil, and stamens enclosed in palea. —L. Caryopsis, dorsal view. —M. Caryopsis, ventral view. —N. Caryopsis, side view. Drawn from the holotype, *J. R. I. Wood 5268* (US).

Hollowell, and an anonymous reviewer for helpful comments that improved this paper.

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A New Name and a New Species in *Matelea* (Apocynaceae, Asclepiadoideae) from Brazil

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Abstract. The new name *Matelea endressiae* Goes & Fontella is proposed to replace *Gonolobus cordatus* Malme from Brazil. A new species, *M. demuneri* Goes & Fontella, from Espírito Santo State, Brazil, is described and illustrated. *Matelea demuneri* is similar to *M. endressiae* and *M. maritima* (Jacquin) Woodson subsp. *cearensis* (Malme) Fontella, but it is distinguished from the first by its shorter pedicel and corolla tube, pubescent corona, and follicles with short projections, and from the second by its mixed indumentum, inflorescence with peduncle, green-purple corolla, rounded 5-lobed corona, shorter pollinia, and follicles with short prickles.

Resumo. Um novo nome, *Matelea endressiae* Goes & Fontella, é apresentado como substituto para *Gonolobus cordatus* Malme, e uma nova espécie, *M. demuneri* Goes & Fontella, do Estado do Espírito Santo, Brasil, é descrita e ilustrada. *Matelea demuneri* é similar a *M. endressiae* e *M. maritima* (Jacquin) Woodson subsp. *cearensis* (Malme) Fontella, porém se distingue da primeira por apresentar pedicelos e tubo da corola menores, corona pubescente e folículos com projeções menores, e da segunda, por apresentar indumento misto, inflorescências pedunculadas, corola verde-arroxeada, corona aneliforme 5-lobada, polínias menores e folículos com projeções menores.

Key words: Apocynaceae, Asclepiadoideae, Brazil, Espírito Santo, IUCN Red List, *Matelea*, Santa Teresa.

The genus *Matelea* Aublet comprises approximately 180 species (Stevens, 2001) distributed from the United States into South America. In Brazil, there are about 44 specific and infraspecific taxa found in primary and secondary rainforest, disturbed areas, cerrado, and campos rupestres formations.

As a result of a study of Asclepiadoideae occurring in Santa Teresa, Espírito Santo State, Brazil, a taxonomic novelty, *Matelea demuneri* Goes & Fontella, is recorded, and a new name, *M. endressiae* Goes & Fontella, is established.

Matelea endressiae Goes & Fontella, nom. nov. Replaced name: *Gonolobus cordatus* Malme, Ark. Bot. 21A(2): 6. 1927. TYPE: Brazil. Ceará: Cedro, 27 Feb. 1910, *A. Loefgren 62* (holotype, S).

The type specimen, *A. Loefgren n° 62*, was identified by Malme as a new species of *Gonolobus* Michaux, as *G. cordatus*. However, this species does not present dorsal anther appendages, which is the main distinguishing characteristic between species of *Gonolobus* and *Matelea* (Woodson, 1941). Because the combination *M. cordata* (Brandegee) Woodson (1941) previously existed, having *Microdactylon cordatus* Brandegee (1908) as its basionym, the new combination could not be made; therefore, the name *Matelea endressiae* is here proposed as a replacement name for *G. cordatus*. The new epithet honors Mary Endress, of the Institute of Systematic Botany, University of Zurich, Switzerland.

Matelea demuneri Goes & Fontella, sp. nov. TYPE: Brazil. Espírito Santo: Santa Teresa, São João de Petrópolis, Barra de Santo Hilário (Paulo Zanette-dono), 10 May 2000, *V. Demuner 1015, E. Bausen, W. Pizziolo & L. Kollmann* (holotype, MBML; isotype, R). Figure 1.

Species nova *Mateleae endressiae* Goes & Fontella affinis, sed ab ea pedicellis et tubo corollae minoribus, corona pubescenti et fructibus aculeis brevibus eburneis armatis praecipue differt.

Vines, with older stems woody and thick, ridged, spongy, pale yellow cork, glabrous; roots tuberous, latex white, internodes 11.5–17 cm; young stems with mixed indumentum, long trichomes moderately dense, 1.2–2 mm, straight, translucent yellow, shorter glandular trichomes dense, red-brown, 0.07–0.15 mm. Leaves simple, opposite, blades ovate to cordate, 6–14.5 × 3–9.2 cm, apex acuminate, base cordate, adaxially with mixed indumentum, sparse long trichomes, straight, translucent yellow, and shorter glandular trichomes, dense, red-brown, abaxially with moderately dense short glandular trichomes, red-brown, and with mixed indumentum on veins; adaxial

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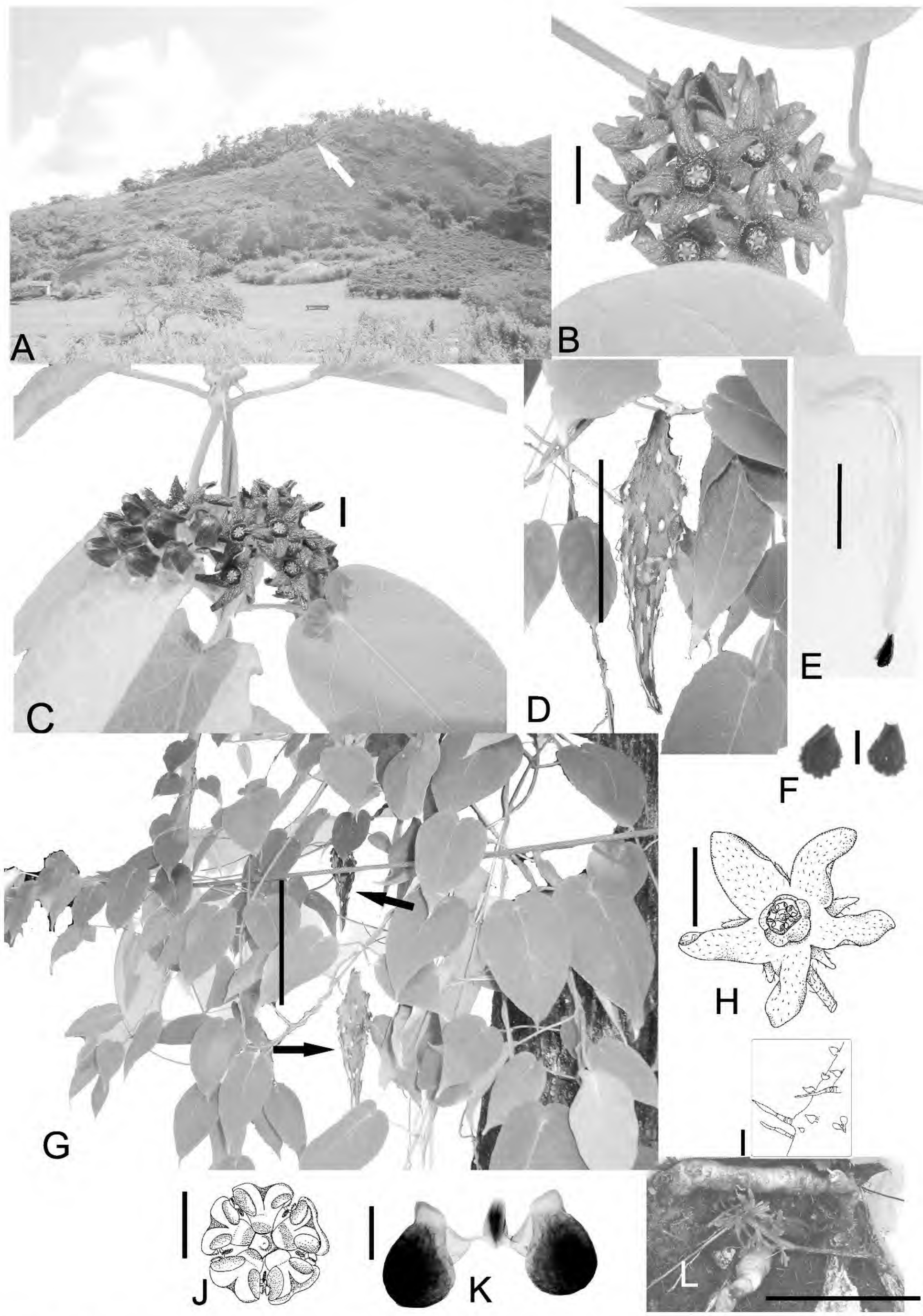

Figure 1. *Matelea demuneri* Goes & Fontella. —A. Habitat, ca. 30 km north of Santa Teresa seat, on the property of Paulo Pascoal Zanetti. The arrow indicates the type locality, on a rocky slope at the forest edge, in an open, dry, and sunny area. —B. Flowering branch. —C. Flowering branch, with post-anthesis flowers and buds just preceding anthesis. —D. Fruit, note the short prickles. —E. Seeds and coma. —F. Seeds, note the irregularly crenate margin. —G. Habit, with two mature fruits (arrows). —H. Flower, frontal view, showing corona and gynostegium. —I. Mixed indumentum with sparse long trichomes and shorter glandular trichomes. —J. Gynostegium, apical view. —K. Pollinarium. —L. Roots. Scale bars: B, C = 6 mm, D = 5 cm, E = 1 cm, F = 5 mm, G = 8 cm, H = 5 mm, J = 1 mm, K = 0.2 mm, L = 10 cm. (B–K, photographed and drawn from cultivated collection. B, C, G–K, *Goes & Barros 108b*; D–F, *Goes & Barros 108c*; L, *Goes & Barros 108a*. Line drawings by Monique Goes.)

Table 1. Morphological comparison of the new species *Matelea demuneri* with *M. endressiae* and *M. maritima* subsp. *cearensis*.

	M. demuneri	*M. endressiae*	*M. maritima* subsp. *cearensis*
Indumentum	mixed: long trichomes moderately dense, straight, translucent yellow, and short glandular trichomes dense, red-brown	mixed: long trichomes moderately dense, straight, translucent white, and short glandular trichomes dense, red-brown	long trichomes dense, flexuose, translucent white
Peduncle length	2–6.2 cm	4–5 cm	1–1.5 mm
Pedicel length	8–12 mm	15–20 mm	1–2 mm
Sepals	ca. 2× longer than corolla tube, linear-lanceolate	as long as corolla tube, lanceolate	ca. 2× longer than corolla tube, ovate
Corolla color	green-purple	purple	green-yellow
Corolla tube length	2.5–3 mm	4–4.5 mm	1–1.2 mm
Corolla lobe length	5.5–6 mm	7–7.5 mm	2–2.5 mm
Corona	rounded, 5-lobed, pubescent, 1–1.5 mm long	rounded, 5 crenate and 5 crenulate, glabrous, 0.75–1.2 mm long	lobes triangular, pilose, and ciliate, 0.3–0.35 mm long
Pollinia	0.28–0.32 mm long, suborbicular	0.35–0.40 mm long, suborbicular	0.6–0.65 mm long, ovate
Follicles	with short prickles, prickles 2.5–3.5 mm	with long prickles, prickles 7–9 mm	with long prickles, prickles 5–6 mm

blade with 5 or 6 colleters at base; petiole 3.5–7 cm, with similar mixed indumentum. Inflorescence umbelliform, with mixed indumentum, 8 to 11 flowers mature at one time, peduncle 2–6.2 cm, pedicel 8–12 mm, bracts 4–12 × 0.3–0.5 mm, linear or narrowly lanceolate, not persistent; calyx tube 1.2–2 mm, with 1 colleter per sinus, lobes linear-lanceolate, 3–4 × 1.5–2 mm, apex acute, green, abaxially with mixed indumentum, adaxially glabrous; corolla briefly campanulate then rotate, abaxially purple-brown, adaxially olive-green and purple at base, or orange when senescent, abaxially with sparse mixed indumentum, adaxially hispidulose, trichomes translucent yellow, 0.24–0.30 mm, corolla tube 2.5–3 mm long, corolla lobes 5.5–6 × 3.5–4 mm, patent, ovate to oblong-ovate, rugose, apex obtuse, shortly twisted; gynostegium sessile, 1–1.2 mm; corona rounded, 5-lobed fused up to the apex, black, exceeding apex of gynostegium, 1–1.5 mm, pubescent, with short trichomes moderately dense, translucent yellow; anthers trapezoidal in outline, guide rails straight, parallel, terminal appendages suborbicular, wings shorter than the dorsal part, corpusculum 0.17–0.21 × 0.05–0.11 mm, oblong, apex truncate, brown, translators 0.23–0.28 mm, pollinia 0.28–0.32 × 0.28–0.30 mm, subglobose to asymmetrically ovate or subovate, yellow, sterile and translucent at attachment; style head apex 0.5–0.8 mm wide, pentagonal, slightly concave, apex briefly mammillate, pale brown. Follicles divergent when double, fusiform, 7.5–11 × 2–2.5 cm, brown, with dense mixed indumentum, follicle apex long attenuate, base stipitate, with scattered short prickles (32 to 45 total), prickles 2.5–3.5 mm long, 1.5–2 mm wide at middle; seeds ovate, 7–8 × 6–6.5 mm, brown, margin 0.9–1.2 mm wide, irregularly crenate on 2/3, surface slightly rugose with coma 3.5–4 cm, white.

In Goes (2007), this species was treated as "*Matelea* sp. nov. 1."

Habitat and distribution. *Matelea demuneri* is known only from forest edges in an open, dry, and sunny area from 656 to 660 m in elevation, in Santa Teresa, Espírito Santo State. It was found growing in a small population, was collected with buds and fruits, and later flowered in cultivation.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), *Matelea demuneri* should be included in the category Critically Endangered (CR). However, there is not enough data to produce a precise conservation evaluation, because much of Espírito Santo State and other states of the Southeast and Northeast regions of Brazil are poorly known.

Phenology. *Matelea demuneri* was observed flowering from August to April and fruiting from November to June.

Etymology. The name of this new species pays homage to Valdir Demuner from Museu de Biologia Professor Mello Leitão, who has made important contributions with his botanical collections to our knowledge of the flora of Santa Teresa, Espírito Santo State, Brazil.

Paratypes. BRAZIL. **Espírito Santo**: Santa Teresa, Santo Antônio do Canaã, Barra do Rio Perdido, Propriedade do Sr. Paulo Pascoal Zanetti, ca. 656 m.s.m., 19 Jan. 2006,

M. B. Goes 99 & E. M. Barros (R), *M. B. Goes 100 & E. M. Barros* (MBML, R), 12 Apr. 2006, *M. B. Goes 108a & E. Barros* (R); cultivated at Sr. Alcides Goes property, in Rio de Janeiro state from *M. B. Goes 108a & E. Barros*, 13 Sep. 2006, *M. B. Goes 108b & E. Barros* (R), 9 Oct. 2006, *M. B. Goes 108c & E. Barros* (MBML, R).

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Cuphea fluviatilis (Lythraceae), a New Species from Antioquia, Colombia

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Abstract. *Cuphea fluviatilis* S. A. Graham, a new species of the Lythraceae from the margins of the Río Samaná in Antioquia Department, Colombia, is described and illustrated. The taxonomic relationships of the species are unsettled. The species bears flowers closely similar to those of species in section *Amazoniana* (Lourteig) Lourteig, but lacks the distinctive malpighiaceous trichomes characterizing the section; its pollen morphology, a significant indicator of broad relationships in *Cuphea*, is also unlike that of the section. Pollen of section *Amazoniana* is typically nonsyncolpate, without protruding pores, and with a psilate to finely rugulate exine; that of *C. fluviatilis* is syncolpate with protruding pores and a striate exine, a type common to numerous species currently classified in the polyphyletic sections *Brachyandra* Koehne and *Euandra* Koehne.

Key words: Colombia, *Cuphea*, IUCN Red List, Lythraceae.

In preparing an account of the Lythraceae for the *Catálogo de las Plantas Vasculares del Departamento de Antioquia, Colombia*, a joint project of the Missouri Botanical Garden and the University of Antioquia, an undescribed species of *Cuphea* P. Browne was discovered. *Cuphea* is the largest genus of the family with more than 260 species and is centered primarily in the eastern Brazilian highlands and secondarily in western and southern Mexico (Graham et al., 2006). The novelty described and illustrated here, *C. fluviatilis* S. A. Graham, appears at a superficial level to be a new member of section *Amazoniana* (Lourteig) Lourteig, but is not taxonomically assigned there. One of the 13 sections of the genus, section *Amazoniana* is atypical, being centered in northwestern South America and mainly occurring in riverine habitats in neighboring humid tropical regions of Venezuela, Colombia, and Brazil. The section is morphologically distinctive and easily recognized, and the species are closely similar, suggesting relatively recent radiation. *Cuphea fluviatilis* is found in Colombia along river margins in the humid tropical forest zone and displays a habit and leaf form common to the section. However, detailed examination including pollen morphology, which has proven highly informative of relationships in *Cuphea* (Graham & Graham, 1971; Graham, 1998; Graham et al., 2006), raises questions about its sectional placement. An evaluation of possible relationships follows the description of the species.

Cuphea fluviatilis S. A. Graham, sp. nov. TYPE: Colombia. Antioquia: Mun. San Luis, Río Samaná Norte, margen izquierda del río, sobre la via Medellín–Bogota, 700–780 m, bht/bmht, 6°00′N, 74°50′O, 23 June 1987, *R. Callejas, A. Arbelaez, H. Correa & J. Betancur 4108* (holotype, HUA not seen; isotypes, MO [2]). Figures 1, 2.

Haec species a congeneris quoad habitum similibus Americae australis partem boreali-occidentalem habitantibus caule setarum adscendentium incrassatarum seriebus duabus internodalibus ornato ceterum glabro, lamina foliari lineari glabra margine setis carnosis parce ciliata, tubo florali praeter setas nonnullas crassas secus costas glabro calcari brevi descendente praedito atque ovulis 4 ad 6 tantum perfacile distinguitur.

Perennial fruticose, multistemmed herbs to 40 cm tall; roots dense, fibrous; stems erect to semi-decumbent, much branched, branches ascending, 5–15 cm, invested by 2 opposing longitudinal rows of thickened, adpressed, ascending setae, the setae enlarged at the base, stems otherwise glabrous; internodes 1–3 mm, substantially shorter than the subtending leaves. *Leaves* decussate, sessile or subsessile; petioles absent or to 0.5 mm; blades linear, 10–30 × 0.3–1.2 mm, uninerved with midvein dark abaxially, thickly membranous, base attenuate, apex rounded, margin thickened or slightly inrolled, sparsely ciliated by well-separated adpressed setae; blade surfaces glabrous; leaves scarcely or not at all reduced in size toward the stem apex. *Inflorescences* leafy terminal racemes; flowers interpetiolar, alternate; pedicels 3–4.5 mm; bracteoles 0.5–0.7 × 0.3–0.5 mm, ovate to oblong, leaf-like, persistent at the apex of the pedicel. *Floral tubes* 5–6.5 × 1–1.2 mm at anthesis including a slightly descending spur 0.4–0.8 mm long, the mouth broadly flaring, 2–2.5 mm diam., blunt, neck not strongly contracted in fruit;

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Figure 1. Isotype of *Cuphea fluviatilis* S. A. Graham (*Callejas et al. 4108*, MO). Inset at bottom: Close-up of flowers from isotype. Scale bar = 5 mm.

outer surface green, sparsely strigose on the ribs, the remainder glabrous; inner surface densely white villous ventrally in the mouth, the indument extending to the level of stamen insertion and along the 2 dorsalmost veins toward the base of the floral tube, surface surrounding the ovary sparsely villous or pilose; calyx lobes deltate, ca. 0.5 × 0.5 mm; epicalyx segments flattened lobes, reaching 1/2 the length of the calyx lobes, bearing a single seta at the apex; petals 6, oblong-spatulate, 2 dorsal ca. 2.2 × 0.7 mm,

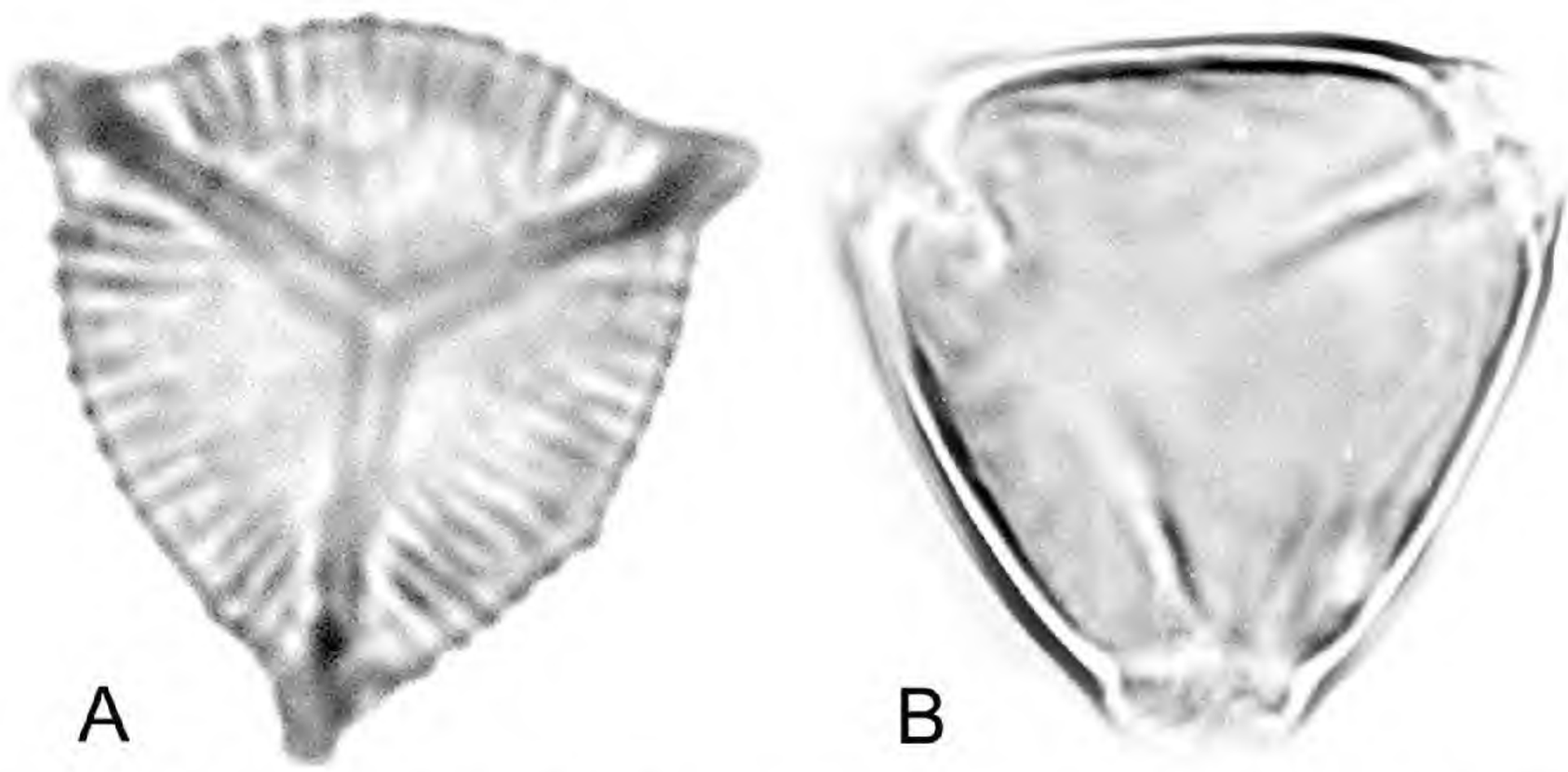

Figure 2. Pollen morphology. —A. *Cuphea fluviatilis*, non-acetolyzed, mounted in lactic acid, actual size 30 μm in diam. —B. *Cuphea kubeorum* Lourteig, an exemplar of pollen from section *Amazoniana*, acetolyzed, mounted in glycerin jelly, actual size 25 μm in diam.

4 ventral 2.8–3 × 0.8–1.2 mm, white or pale pink; stamens 11, the 2 dorsalmost shortest, inserted slightly below the other 9, the others equally inserted, 3 ventral long stamens glabrous, the others villous, all included, anthers of the longest antesepalous ones scarcely reaching the sinus of the calyx lobes; pollen oval-triangular in outline, tricolporate, syncolpate, pores protruding; exine uniformly striate, diam. 27–30 μm in lactic acid; ovary pilose distally, nongibbous; style pilose at base, included, equal to longest stamens at anthesis, ultimately exserted; stigma small, capitate; ovules 4 to 6; nectariferous disc erect, perpendicular to the base of the ovary, thick, dark red, 0.6–1 mm wide in dorsal view. *Seeds* ca. 1.4 × 1.5 mm, suborbicular, apex retuse, margin rounded.

Distribution and phenology. *Cuphea fluviatilis* is known only from the type area, at the margin of rivers at 500–780 m. It has been collected in flower and fruit in March and June and probably flowers throughout most of the year.

IUCN Red List category. Conservation status for *Cuphea fluviatilis* is Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001) because the species is known only from the type collection.

Discussion. This small linear-leaved shrub is uniquely differentiated from a number of *Cuphea* species with similar habit and habitat in northwestern South America by: two internodal rows of ascending, thickened setae on an otherwise glabrous stem; linear leaves with glabrous blades and a sparsely ciliate margin of fleshy setae; floral tubes glabrous except for a few coarse adpressed setae on the ribs and with a short descending spur; and ovules numbering only four to six (Fig. 1). Additionally, the pollen is syncolpate with protruding pores and striate exine (Fig. 2A).

Within the genus, *Cuphea fluviatilis* agrees most closely with members of section *Amazoniana*. The section comprises 20 species with malpighiaceous trichomes, dorsal petals narrower than the ventral petals, and with distribution primarily along rivers in the western Amazon (Lourteig, 1986). The section (first published as a subsection) was drawn out of the South American section *Euandra* subsect. *Hyssopocuphea* Koehne p.p. (Lourteig, 1959) and subsequently expanded as new species were discovered in poorly explored parts of Amazonian Venezuela and Colombia (Lourteig, 1986, 1996). Flower morphology of *C. fluviatilis* is characteristic of section *Amazoniana*, i.e., the floral interior villous; nectariferous disc thick, short, and erect; ovary and style base pilose; and seeds less than 2 mm long. Unlike other members of the section, however, *C. fluviatilis* does not bear the conspicuous malpighiaceous trichomes that are a major diagnostic character of the section, and the pollen does not correspond to that of the section. The pollen of all members of section *Amazoniana* lacks protruding pores, is psilate or finely rugulate, and generally is nonsyncolpate (Fig. 2B).

Pollen morphology has been of great value in recognizing relationships in *Cuphea* that are obscured by floral homoplasy. Although some pollen features are also homoplastic, related plant species can share virtually identical pollen and some sections or clades are recognizable based on pollen morphology (Graham & Graham, 1971; Graham, 1998; Graham et al., 2006). The syncolpate striate pollen type of *C. fluviatilis* is a widespread form that appears in several phylogenetic lineages whose species have been

classified in either sections *Brachyandra* Koehne or *Euandra* Koehne (Koehne, 1903, but also see Graham, 1998: fig. 3a, section *Brachyandra*/*C. pseudosilene* Grisebach; Graham & Graham, 1971: fig. 14, section *Euandra* subsect. *Platypterus* Koehne/ *C. corisperma* Koehne and fig. 17, *C. carunculata* Koehne).

The type collection of *Cuphea fluviatilis* was originally determined as aff. *C. hyssopifolia* Kunth (sect. *Euandra* subsect. *Hyssopocuphea*), another linear-leaved fruticose member of the genus that is found along river margins in humid tropical areas, especially in Central America. That species is superficially similar to *C. fluviatilis* in its habit, small flowers with ovate bracteoles, and seeds less than 2 mm long. The flowers differ in being a spurless, slender tube and the pollen is nonsyncolpate with nonprotruding pores and a psilate exine as in section *Amazoniana*. At present, without independent molecular evidence, the relationships of *C. fluviatilis* are unclear. It shares floral morphology, but not plant indument or pollen type with members of section *Amazoniana* and in other respects displays features held in common by numerous members of the large polyphyletic sections *Brachyandra* and *Euandra* without apparent close relationship to any particular species.

Paratype. COLOMBIA. **Antioquia:** Mun. San Luis, margen del Río Samaná, Vereda el Portón, camino a la autopista Medellín–Bogotá, 5°57′N, 74°57′W, 4 Mar. 1990, *D. Cardenas L., J. G. Ramirez & J. Mejia 2507* (JAUM not seen, MO).

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A New Species of *Cyclanthera* (Cucurbitaceae) from Alajuela Province, Costa Rica

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Abstract. *Cyclanthera lalajuela* Hammel & J. A. González, known only from the Caribbean slope of Alajuela Province, Costa Rica, is described. The combination of trifoliolate leaves with conspicuous, sessile glands at the base of the leaflets and unarmed fruits distinguish it from all other species in the genus.

Resumen. Se describe *Cyclanthera lalajuela* Hammel & J. A. González, conocida solamente de la vertiene caribeña de la provincia de Alajuela, Costa Rica. La combinación de hojas trifolioladas con glándulas sésiles, conspicuas en la base de las hojuelas y sus frutos inermes la distingue de todas las demás especies del género.

Key words: Alajuela, Costa Rica, Cucurbitaceae, *Cyclanthera*, IUCN Red List.

Perhaps most new species described today are ones found by specialists who have worked many years in a given group, have personally collected the species, may have even known them for many years, accumulating numerous new ones to publish in revisionary compendia. Many, however, also come to light as a result of work on country or regional floras. Since its beginning over 15 years ago, the *Manual de Plantas de Costa Rica* project has recorded over 50 species new to Costa Rica per year, more than half of them new to science (cf. Zamora et al., 2004). The rather cryptic new species of *Cyclanthera* Schrader (Cucurbitaceae, Cyclanthereae) described below was first collected in flower in 1935 by San Ramon's patron saint of botany, Alberto Brenes (1870–1948); however, no other fertile collections were made until W. Haber's fruiting specimen of 1988, near the beginning of the Manual project. Restricted to wet forests of the Caribbean slope of Alajuela Province that even now remain quite isolated, the species is still only known from six fertile collections, but is here recognized as distinct from all others in this Neotropical genus of ca. 30 species.

Cyclanthera lalajuela Hammel & J. A. González, sp. nov. TYPE: Costa Rica. Alajuela: Cantón de Tilarán, San Gerardo, Río Caño Negro, Finca de Marcos Vargas, 850 m, 12 Jan. 1989 (fl.), *Erick Bello 658* (holotype, INB; isotypes, CR, MO). Figure 1.

Species insignis foliis trifoliolatis, foliolis subintegris (elobatis sed inconspicue crenulatis vel denticulatis) glandulis conspicuis basi ornatis et fructibus laevibus a speciebus congericis nobis notis bene distincta.

Slender monoecious vine; stem nodes puberulent. Petioles 1–2.5 cm, puberulent at apex. Leaves trifoliolate, orbicular to oblate, 5–10 × 6–12 cm; leaflets markedly petiolulate, petiolules 0.5–1.5 cm, central leaflet 5–10 × 2.5–5 cm, elliptic to obovate, nearly entire (indistinctly crenate to denticulate), lateral leaflets similar, unlobed but inequilateral; both blade surfaces glabrous but ± papillose-scabrous; conspicuous glands at base of leaflets on abaxial surface, usually 1 to 13 per side, often also 1 to 3 glands near apex; tendrils bifid. Staminate inflorescences alone or co-axillary with a pistillate flower, narrowly paniculate, 3–7(–13) cm, floriferous nearly to the base; pedicels 2–3.5 mm, glabrous. Staminate flowers with the calyx tube ca. 1.5 mm wide, calyx teeth ca. 0.5 mm, triangular; corolla white, greenish white to cream, 3–4.5 mm wide, petals 5, 1–2 mm; filament column 0.2–0.3 mm, staminal disk 0.5–0.6 mm diam. Pistillate flowers solitary, co-axillary with a staminate inflorescence, peduncle 6–20 mm; ovary 2.5–5 mm, narrowly elliptic with a beak ca. 1.5 mm. Fruits with a peduncle ca. 3.5 cm, the body ca. 5.5 × 2 cm, basally gibbose, acuminate to the apex, smooth; seeds not seen.

Distribution and IUCN Red List category. This species as presently known, endemic to Alajuela Province, Costa Rica, is found only on the Caribbean slope of the Guanacaste and Tilarán mountain ranges, from 700–1200 m elevation. The species has been recorded from Arenal Volcano National Park, as well as from the San Gerardo Biological Station, so it does not seem to be in imminent danger from direct human intervention or deforestation. However, considering the apparent rarity of the species and its isolation in

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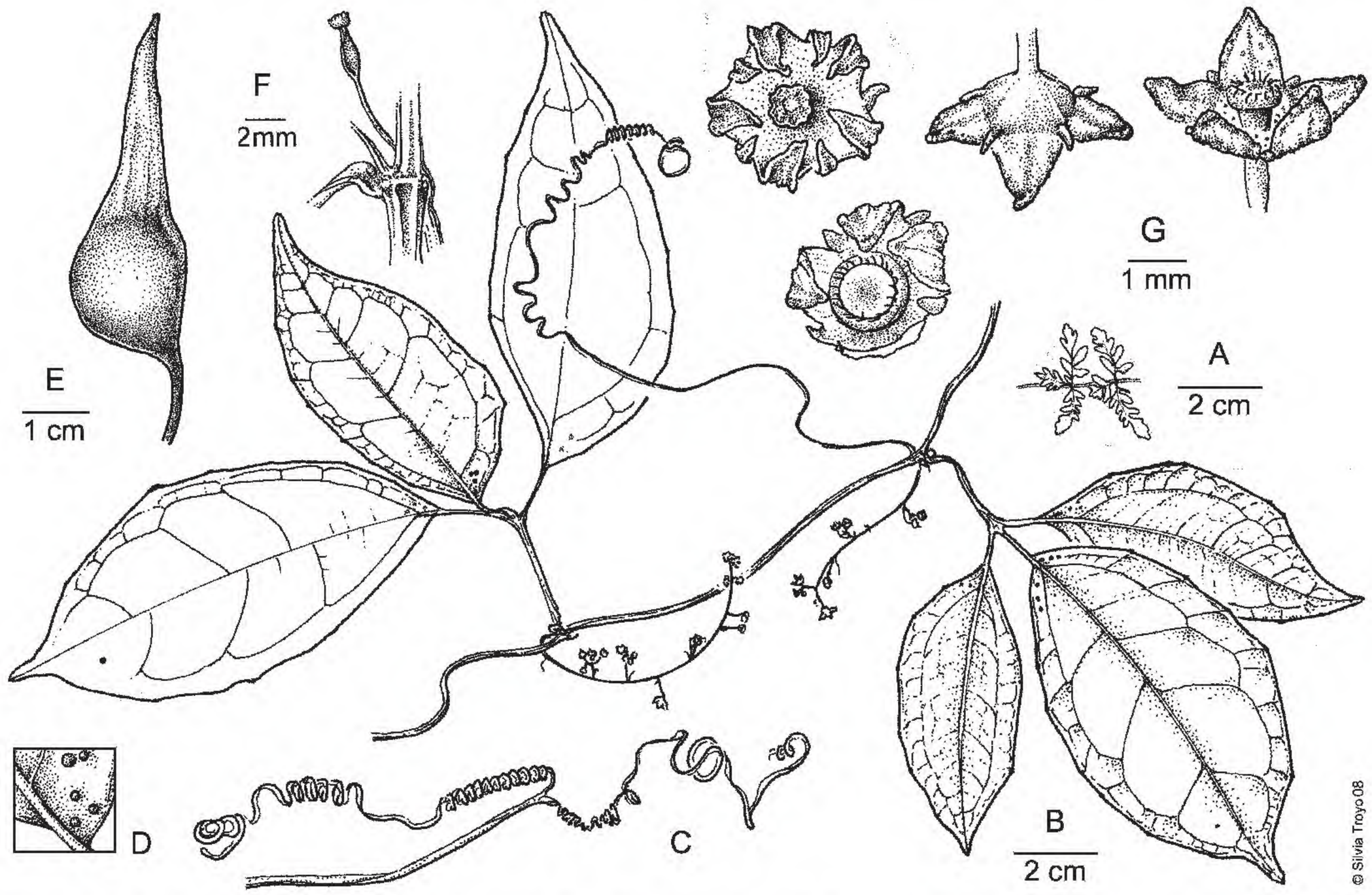

Figure 1. *Cyclanthera lalajuela* Hammel & J. A. González. —A. Juvenile leaves. —B. Habit. —C. Typical bifurcate tendril. —D. Detail of glands on base of leaflet, abaxial surface. —E. Fruit. —F. Pistillate flower. —G. Different views and stages of staminate flowers. (A, from *Austin Smith H60*, F; B–D, from *A. Rodríguez et al. 6268*, INB; E, from *Haber 8071*, CR; F, G, from the holotype, *Bello 658*, INB.)

one small region of the Caribbean, mid-elevation wet forests, it should be classified as Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001).

Etymology. Because this species was, in part, exhumed from rather old collections, we have chosen to name it by exhuming the original name of the town and now province to which it is endemic, "La Lajuela." The combined form "lalajuela" (from which the current "Alajuela" was eventually derived by dropping the initial "l") is used here simply as a noun in apposition (cf. Art. 23.1, McNeill et al., 2006) and not meant to be latinized.

Discussion. At first glance, one somewhat familiar with the Costa Rican flora might easily mistake this new species for a species of *Cissus* L. (Vitaceae) or *Cayaponia* Silva Manso (Curcurbitaceae), since all other Costa Rican species of *Cyclanthera* have either simple leaves or compound and pedately lobed leaves. As it turns out, in part for that very reason, *C. lalajuela* is quite different from all the other ca. 30 recognized species of the genus, i.e., by virtue of its strictly trifoliolate leaves with subentire leaflets (all leaflets inconspicuously toothed and unlobed), as well as by its conspicuous glands at the base of the leaflets, and its smooth fruits. The glands at the base of the leaflets alone would seem sufficient to distinguish the new species from all others in the genus; in the most recent revison of the genus, it was stated that such glands "are often found at the base of the simple leaves..., but are never found on the leaves of the compound-leaved species" (Jones, 1969: 3). More recently, Lira (1995: 205, clave de identificación, lead 1a), in a treatment of the 23 species known to him, promulgated the same idea. Finally, neither of the two compound-leaved species described after or not in time for Lira's study (*C. heiseri* C. E. Jones & Kearns and *C. jonesii* McVaugh) is said to have laminar glands (Jones & Kearns, 1994; McVaugh, 2001). Nevertheless, most Costa Rican material of the compound-leaved *C. multifoliola* Cogniaux (including *Tonduz 10904* [CR, US], annotated by Jones) has conspicuous glands at the base of the leaflets of its compound (3- to 5-foliolate) leaves. Apart from the similar laminar glands, *C. lalajuela* bears little resemblance to *C. multifoliola*, the latter having leaflets that are strongly toothed and (the lateral ones) pedately lobed, echinate fruits, and a sessile staminal disk. The cultivated *C. pedata* (L.) Schrader is apparently the only other compound-leaved *Cyclanthera* that often has more or less unarmed (though much larger) fruits, but its leaves are at least

5-foliolate, the leaflets are strongly toothed and lack both petiolules and laminar glands, and the lateral leaflets are deeply and pedately lobed. We know of only one other *Cyclanthera* species, *C. eichleri* Cogniaux, reported to have unarmed fruits. That species, known only from the type, from the province of Rio de Janeiro, Brazil, has simple (obscurely 3- to 5-lobed) leaves, apparently without glands.

Following Jones (1969) and Lira (1995), *Cyclanthera lalajuela*, by virtue of its trifoliolate leaves, stalked androecial column, and fruit peduncle shorter than the leaf petioles, would key out in the vicinity of *C. dissecta* (Torrey & A. Gray) Arnott and *C. rostrata* (Paul G. Wilson) Kearns & C. E. Jones (as "C. parviflora"), both with armed and smaller (0.3–3 vs. ca. 5 cm) fruits and leaves that lack glands.

Unarmed fruits are unusual in *Cyclanthera*. The only well-known species that frequently lacks spines is *C. pedata*; the occurrence of spines in that species is variable, and its wild relatives have spiny fruits (M. Nee, pers. comm.). Unarmed fruits in *C. pedata* are surely a result of human selection; the species is cultivated in Central and South America for its large, virtually hollow, edible fruits (common names in Costa Rica: caiba, caífa, jaiba), which are used mostly, like bell peppers, to be filled and baked. We have seen only one fruit (close to mature?) of *C. lalajuela* and several pistillate flowers and very young fruits, but in no case do we find any evidence of spines or protuberances. Even if future collections should prove that this new species can indeed have armed fruits, its strictly trifoliolate leaves with subentire leaflets and conspicuous glands would still distinguish it from all other species in the genus.

The two specimens cited here with very small, juvenile leaves are suspected of belonging to this species because of their locality and certain aspects of their leaf morphology. Somewhat unexpectedly, however, their simple to trifoliolate leaves are profusely lobulate (see Fig. 1A).

Paratypes. COSTA RICA. **Alajuela:** Cantón de San Carlos, P.N. Volcán Arenal, Cerro Chato, sendero que lleva a la Laguna, 22 Aug. 2000 (fl.), *A. Rodríguez, V. Ramírez & G. Soto 6268* (INB); entre La Tigra y Nuevo Arenal, entrando por Linda Vista y Venado, 25 Apr. 2007 (fl.), *D. Santamaría, C. Persson & A. Antonelli 3267* (CR, INB, MO); Cantón de San Ramón, entre La Balsa et Cataratas a San Ramón, 12 Oct. 1925 (juv.), *Brenes 307* [Hb. Brenes 4522] (F852636); Cataratas de San Ramón, 21 Feb. 1931 (fl.), *Brenes 3028 (61)* [13744 (Hb. Brenes)] (CR), *Brenes s.n.* [13450 Hb. Brenes] (F857204); Monteverde, Río Peñas Blancas, 13 Jan. 1988 (fl., fr.), *W. Haber 8071* (CR, MO); Monteverde, San Gerardo Biol. Station, 26 July 1995 (fl.), *Darin Pennys 631* (INB, MO); Cantón de Tilarán, Reserva Forestal de Arenal, Quebrada San Gerardo, Río Caño Negro, Finca de Enrique Quesada y Ceferino González, 19 Feb. 1990 (fl.), *Erick Bello 1929* (INB, MO); Cantón de Zarcero, 9 Jan. 1938 (juv.), *Austin Smith H60* (F).

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Zamora, N., B. E. Hammel & M. H. Grayum. 2004. Novelties. Pp. 217–240 *in* B. E. Hammel, M. H. Grayum, C. Herrera & N. Zamora (editors), Manual de Plantas de Costa Rica, Vol. 1: Introducción. Monogr. Syst. Bot. Missouri Bot. Gard. 97.

Forestiera isabelae (Oleaceae), una Especie Nueva para Costa Rica

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Resumen. Se describe y se ilustra *Forestiera isabelae* Hammel & Cornejo, conocida de una sola población pequeña en Costa Rica, por Montezuma en la Península de Nicoya. Siendo una especie costera con pétalos, y además con hojas y frutos relativamente grandes (9–17 × 4–6 cm y 15–20 mm, respectivamente), se separa fácilmente de las otras dos especies costarricenses, apétalas y de elevaciones más altas. Se compara con y se distingue detalladamente de otras dos especies costeras recién descritas y con las cuales está cercanamente relacionada, *F. corollata* Cornejo & Wallander de más al norte en Mesoamérica (México, Guatemala y Belice) y *F. ecuadoriensis* Cornejo & Bonifaz del Ecuador.

Abstract. *Forestiera isabelae* Hammel & Cornejo, known from one small population near Montezuma on the Nicoya Peninsula of Costa Rica, is described. As a lowland coastal species with petals and relatively large leaves and fruits (9–17 × 4–6 cm and 15–20 mm, respectively), it is easily distinguished from the two other Costa Rican species, both apetalous and from higher elevation. It is compared with and distinguished in detail from two other more closely related, recently described coastal species, *F. corollata* Cornejo & Wallander from farther north in Mesoamerica (Mexico, Guatemala, and Belize) and *F. ecuadoriensis* Cornejo & Bonifaz from Ecuador.

Key words: Costa Rica, *Forestiera*, IUCN Red List, Nicoya Peninsula, Oleaceae.

Forestiera Poiret (Oleaceae) es un género de arbustos y árboles que comprende 14 especies distribuidas desde Estados Unidos hasta Ecuador y el Caribe (Cornejo & Bonifaz, 2006; Cornejo & Wallander, 2007). En Costa Rica se conocen solamente tres especies de *Forestiera*, entre ellas, dos de las especies reportadas en el *Manual de Plantas de Costa Rica* (González, 2007) se indicaban provisionalmente solamente con letras. Una de ellas resulta ser una especie nueva para la ciencia, aquí formalmente descrita. La otra aún queda por resolver, pero posiblemente su nombre correcto sea *F. reticulata* Torrey (E. Wallander & X. Cornejo, com. pers.).

Forestiera isabelae Hammel & Cornejo, sp. nov. TIPO: Costa Rica. Puntarenas: Cantón de Puntarenas, Península de Nicoya, Montezuma, por el camino que sube hacia Cóbano desde el lado sur del Río Montezuma, ca. 200 m después de la entrada, intersección con camino a Cabuya, 50 m, 10 dic. 2005 (fr.), *B. Hammel & I. Pérez 23934* (holotipo, INB; isotipos, COL, CR, MO, NY, P, QCNE). Figura 1.

Haec species a *Forestiera corollata* Cornejo & Wallander petalis (1.5–3.5 vs. 1.2–2.3 mm) et fructibus (15–20 vs. 8–10 mm) longioribus, a *F. ecuadorensi* Cornejo & Bonifaz floribus petalatis et filamentis staminium (3–4.5 vs. 1–1.7 mm) longioribus, a specie caribaea *F. rhamnifoliae* Grisebach floribus petalatis, laminis foliaribus (9–17 × 4–6 vs. 2–8.5 × 1–3 cm) majoribus cum nervis secundariis (8 ad 14 vs. 3 ad 7) multioribus et fructu (15–20 vs. ca. 8 mm) longiore recedit.

Arbustos o árboles, 4–15 m, poligamodioica, con por lo menos algunos individuos con flores estaminadas y flores hermafroditas, otros con sólo flores pistiladas; ramas diminutamente puberulentas (tricomas menos de 0.1 mm) a glabrescentes. Hojas con el pecíolo 4–12 mm; lámina 9–17 × 4–6 cm, ampliamente elíptica a oblongo-obovada, cuneada y ± decurrente en la base, aguda a abruptamente acuminada (el acumen 10–20 mm) en el ápice, entera, glabra, excepto diminuta y esparcidamente puberulenta sobre el haz de la base del nervio medio de las hojas más nuevas, el envés con diminutos puntos glandulares de color ámbar ± igualmente esparcidos o a veces más concentrados por el nervio medio; nervios secundarios 8 a 14 por lado, a menudo muy difíciles de distinguir (de los nervios intersecundarios

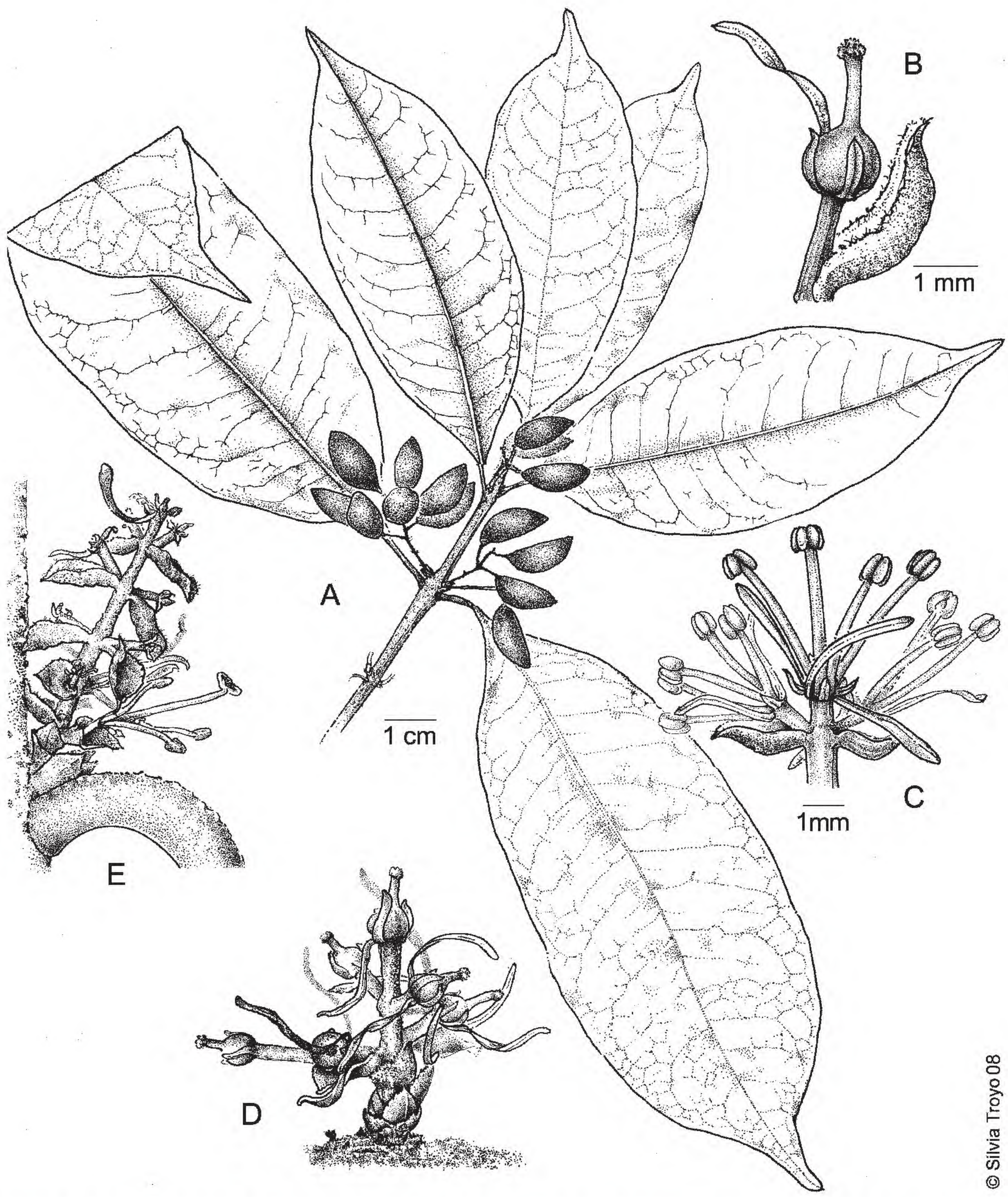

Figura 1. *Forestiera isabelae* Hammel & Cornejo. —A. Rama terminal con infructescencias. —B. Flor pistilada con bráctea y un pétalo. —C. Flores estaminadas. —D. Inflorescencia pistilada. —E. Inflorescencia estaminada. (A, del tipo *Hammel & Pérez 23934*; B y D, de *Hammel & Pérez 24250*; C y E, de *Hammel & Pérez 24248*.)

y terciarios), a un ángulo de 75°–85° con el nervio medio. Inflorescencias axilares y supraxilares (a menudo en nudos deshojados), 5–20 mm, racemosas, con 2 ó 3 pares de bractéolas basales, decusadas, 0.5–1.5 mm, triangulares a subcordadas; brácteas florales 1–2.5 × 0.5–1 mm, elípticas a obovado-espatuladas, el ápice fimbriado-ciliado a entero. Flores 5 a 13, en pares bracteados más una terminal ebracteada, los pedicelos 0.5–2 mm; sépalos 4, libres, 0.3–0.7 mm, linear-triangulares; pétalos 4 ó 5, libres, crema verdoso en la antesis, que se vuelven anaranjado amarillento, desiguales, 1.5–3.5 mm, linear-ligulados, pronto caedizos; estambres (flores estaminadas y hermafroditas) 4 ó 5, con el filamento 3–4.5 mm, la antera ca. 0.5 mm, ovoide; ovario (flores pistiladas y hermafroditas) ca. 0.5 mm, ovoide-turbinado, el estilo

ca. 0.5 mm, el estigma ± capitado, papiloso-puberulento. Infructescencias 2–3.5 cm (incl. los frutos); frutos morados a negruzcos, glaucos, 15–20 mm, elipsoides.

Distribución y estado de conservación. Esta especie se conoce solamente de Costa Rica y allí de una sola población en bosque húmedo de la Península de Nicoya, al lado del mar y muy cerca al pueblo de Montezuma, a lo largo del Río Montezuma. La población parece ser bastante grande, tal vez de unos 100 individuos que se encuentran dispersos justo al lado del río (hasta casi llegar a la catarata), pero también a lo largo del camino en la fila con vista al mar, hasta llegar más o menos a la altura de la catarata. Con base en el negativo resultado de exploración—en ambientes muy parecidos—esporádica y específica, río arriba de la catarata en el Río Montezuma y por otros ríos, quebradas y filas con vista al mar de la misma zona, y estudios más intensivos e inclusivos en la cercana Reserva Absoluta Cabo Blanco, extraña la restringida distribución de esta especie. El área total que ocupa la población es menos que 1 km^2 y se ubica en una zona que rápidamente se está desarrollando para el turismo. Si protegida, será principalmente a razón de las pendientes fuertes a lo largo del río. La ley forestal en Costa Rica contempla la protección de bosque a lo largo de nacientes permanentes, pero rige solamente sobre una franja de 15 m a lo largo de cada lado de la naciente. En realidad la vigilancia y la aplicación de las leyes es nula en todos los casos, en todo el país. En fin, todos los bosques en Costa Rica, al igual que *Forestiera isabelae*, están en peligro. Más por lógica que por cálculos exactos, es obvio que la especie se debería clasificar como Vulnerable (VU), según el IUCN (2001).

Etimología. Esta especie se dedica a Isabel Pérez Blanco, la esposa del primer autor, quien, felizmente le ha acompañado en prácticamente todas sus giras al campo de este siglo. Fue con la ayuda de ella que se logró recolectar la especie con flores y frutos maduros, tras numerosas visitas al sitio, durante el transcurso de más de un año.

Discusión. De las dos otras especies de *Forestiera* en Costa Rica, *F. isabelae* se distingue fácilmente por tener pétalos, por sus hojas y frutos más grandes, y por su hábitat costero. Molecularmente esta nueva especie está relacionada con las recientemente descritas y también conocidas de zonas costeras *F. ecuadoriensis* y *F. corollata* (E. Wallander & X. Cornejo, com. pers.). Desafortunadamente, estas dos especies son incompletamente conocidas, la primera con base solamente en material estaminado, la segunda en material pistilado (ver Cornejo & Bonifaz, 2006; Cornejo & Wallander, 2007). Sin embargo, *F. isabelae* se puede distinguir de la primera por tener flores con pétalos (vs. apétala) y por sus estambres con filamentos más largos (3–4.5 mm vs. 1–1.7 mm); y de la segunda se distingue por tener láminas con conspicuos, obscuros (vs. inconspicuos) nervios terciarios en el envés (al secar), y los pétalos (1.5–3.5 mm vs. 1.2–2.3 mm) y frutos (15–20 mm vs. 8–10 mm) más grandes. Además, mientras observamos solamente dos o tres pares de brácteas basales en *F. isabelae*, se ha notado que *F. corollata* tiene cinco o seis pares. Cuando en 1991 recolectamos por primera vez esta *Forestiera* costera en Costa Rica, la habíamos comparado con material centroamericano entonces identificado como *F. rhamnifolia*. Sin embargo, al revisar el manuscrito de la familia Oleaceae para el *Manual de Plantas de Costa Rica* (ver González, 2007) nos dimos cuenta que *F. rhamnifolia* s. str. se trata de una especie con hojas más pequeñas y con menos nervios laterales, que probablemente esté restringida a Cuba y otras islas caribeñas (Cornejo & Wallander, 2007). En el *Manual* la presente especie fue registrada como *Forestiera* sp. A. De hecho, subsecuentemente parte de dicho material centroamericano (exclusivo del presente material costarricense) fue descrito como *F. corollata* (Cornejo & Wallander, 2007). Es posible que la presente separación del material costarricense con base en pétalos y frutos más grandes de lo conocido para *F. corollata* sea simplemente a razón de las pocas recolecciones conocidas de esta última. Pues si subsanando dicha pobreza se da cuenta que material dentro del área de distribución de *F. corollata* tuviera pétalos y frutos tan grandes como los del material de Costa Rica, será comprobada esta conjetura. Por otro lado, aquí se propone que la separación morfológica indicada se ha dado a razón de un aislamiento físico suficientemente largo en espacio y tiempo entre estas especies hermanas, y que será comprobado con más recolecciones. Es curioso que el único individuo observado de *F. isabelae* con flores estaminadas también presentaba flores hermafroditas, condición conocida como andromonoica y al parecer no reportada para otras especies del género.

Paratipos. COSTA RICA. **Puntarenas:** Cantón de Puntarenas, Montezuma, en bosque a lo largo del Río Montezuma, del puente hasta la catarata, y por el camino, desde el puente hasta ca. 1 km arriba, 10–100 m, 18 ago. 1991 (fr.), *B. Hammel 18350* (CR, INB, MO), 20 nov. 2005 (fr.), *B. Hammel & I. Pérez 23892* (CR, INB), 11 dic. 2005 (fr.), *B. Hammel & Pérez 23943* (INB, USJ), (fr.), *Hammel & I. Pérez 23945* (INB, K, US), 12 dic. 2005 (fr.), *B. Hammel & I. Pérez 23956* (BM, F, INB, PMA), 8 jul. 2006 (estéril), *B. Hammel & I. Pérez 24142* (CR, INB, MO), (est.), *B. Hammel & I. Pérez 24148* (CR, INB, JVC), (est.), *B. Hammel & I. Pérez 24150* (CR, INB, USJ), 30 jul. 2006 (botones florales),

B. Hammel & I. Pérez 24169 (INB), (bots. fls.), *B. Hammel & Pérez 24174* (INB), 17 ago. 2006 (bots. fls.), *Hammel & I. Pérez 24184* (INB), 30 sep. 2006 (fls. ♂ y ♂♀), *B. Hammel & I. Pérez 24248* (BM, COL, CR, F, INB, JVC, K, MICH, MO, NY, P, QCNE, US, USJ), 30 sep. 2006 (fl. ♀), *B. Hammel & I. Pérez 24250* (CR, INB, MO, NY), 30 sep. 2006 (est.), *B. Hammel & I. Pérez 24252* (CR, INB, MO), 25 nov. 2007 (fr.), *B. Hammel & I. Pérez 24410* (CR, INB, JVC, MO, NY, US, USJ).

Agradecimientos. Estamos agradecidos a Silvia Troyo (INBio) por la fina ilustración, hecho con base en muestras, fotos, y flores conservadas en alcohol. Este trabajo se pudo adelantar, en parte, gracias a una pasantía (durante mayo y junio de 2006) al primer autor como investigador visitante al Muséum National d'Histoire Naturelle, Departement Systématique et Evolution, Herbier National (P). Se agradece tanto a dicha institución por el apoyo económico como a todos los curadores, bibliotecarias y asistentes quienes tan gratamente dieron de su tiempo, facilitando mucho la estadía. También estamos agradecidos a Eva Wallander por facilitar datos preliminares de un estudio filogenético del género *Forestiera* con base en ADN, los cuales ayudaron a aclarar relaciones entre las especies discutidas. Se agradece a dos revisores científicos por sus bienvenidos comentarios.

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Cephalanthera nanlingensis (Orchidaceae), a New Species from Guangdong, China

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Abstract. *Cephalanthera nanlingensis* A. Q. Hu & F. W. Xing, a new species of Orchidaceae from Guangdong, China, is described and illustrated. It is similar to *C. longifolia* (L.) Fritsch and *C. erecta* (Thunberg ex A. Murray) Blume, sharing slender stems, plicate leaves, and white flowers. The new species is distinguished by its deltoid bracts and a subactinomorphic perianth.

Key words: Cephalanthera, China, IUCN Red List, Orchidaceae.

The orchid genus *Cephalanthera* Richard belongs to the tribe Neottieae of the subfamily Epidendroideae (Pridgeon et al., 2005) and consists of ca. 12 species mainly found in northern temperate regions with a few species extending south to the Himalayas and northern Africa (Su, 2000). There are 10 species of *Cephalanthera* recorded from China (Zhu, 1999; Chen & Zhu, 2002).

During four botanical expeditions to Ruyuan County in northern Guangdong Province, China, we collected a peculiar *Cephalanthera* with a subactinomorphic perianth. After careful study, we concluded that this is a new species closely related to *C. longifolia* (L.) Fritsch and *C. erecta* (Thunberg ex A. Murray) Blume.

Cephalanthera nanlingensis A. Q. Hu & F. W. Xing, sp. nov. TYPE: China. Guangdong: Ruyuan, Nanling Mtns., 24°94′N, 113°10′E, 1500 m, 19 Apr. 2006, *Ai-Qun Hu 46* (holotype, IBSC; isotype, PE). Figure 1.

Species affinis *Cephalantherae longifoliae* (L.) Fritsch, sed ab ea bracteis omnibus deltatis 2–3 mm longis, perianthio fere actinomorpho, labello petalis lateralibus simili atque sepalis 7–8 mm longis petalis leviter longioribus differt.

Terrestrial herb, 13–24 cm tall, with short and indistinct rhizome; roots fasciculate, fibrous, 2–3 mm diam.; stems slender, somewhat flexuous, slightly ridged, 1–1.5 mm diam., glabrous, bearing sheaths at base; sheaths brown, cylindric, increasing in size acropetally, the lowest one scaly. Leaves 3 to 6, papyraceous, subsessile, plicate, elliptic to lanceolate, acuminate at apex, contracted at base, 32–46 × 8–12 mm, glabrous, 5- to 7-veined. Inflorescence a raceme, 3.2–5 cm, 3- to 5-flowered; bracts deltoid, 2–3 mm, obviously shorter than pedicellate ovary; pedicel and ovary green, 8–11 mm, glabrous, claviform, slightly ridged. Flowers white, 7–8 mm, suberect, slightly or not opening at anthesis; perianth subactinomorphic; sepals free, cymbiform, suboblong, obtuse at apex, unguiculate at base, 7–8 × 2–2.5 mm, 3(5)-veined; lip similar to petals; petals obovate, obtuse at apex, unguiculate at base, 5–6.5 × 1.7–2 mm, 4- to 5-veined; column erect, semi-terete, ca. 5 × 1 mm; anther erect, hinged to the top of the column by a short stalk, ovate to cordate, ca. 1.5 mm, 2-celled; stigma subterminal, oblate to concave; staminodes 2, ligulate, obtuse at apex; rostellum absent; pollinia 2, each divided into 2 halves, ca. 1 mm, white, naked, farinaceous. Fruit not seen.

Habitat and distribution. Cephalanthera nanlingensis grows at the edge of evergreen broad-leaved forests in which *Castanopsis eyrei* (Champion ex Bentham) Tutcher, *Elaeocarpus sylvestris* (Loureiro) Poiret, *Schima remotiserrata* Hung T. Chang, and *Pleioblastus amarus* (Keng) Keng f. are dominant. So far, the new species is known only from two sites in the

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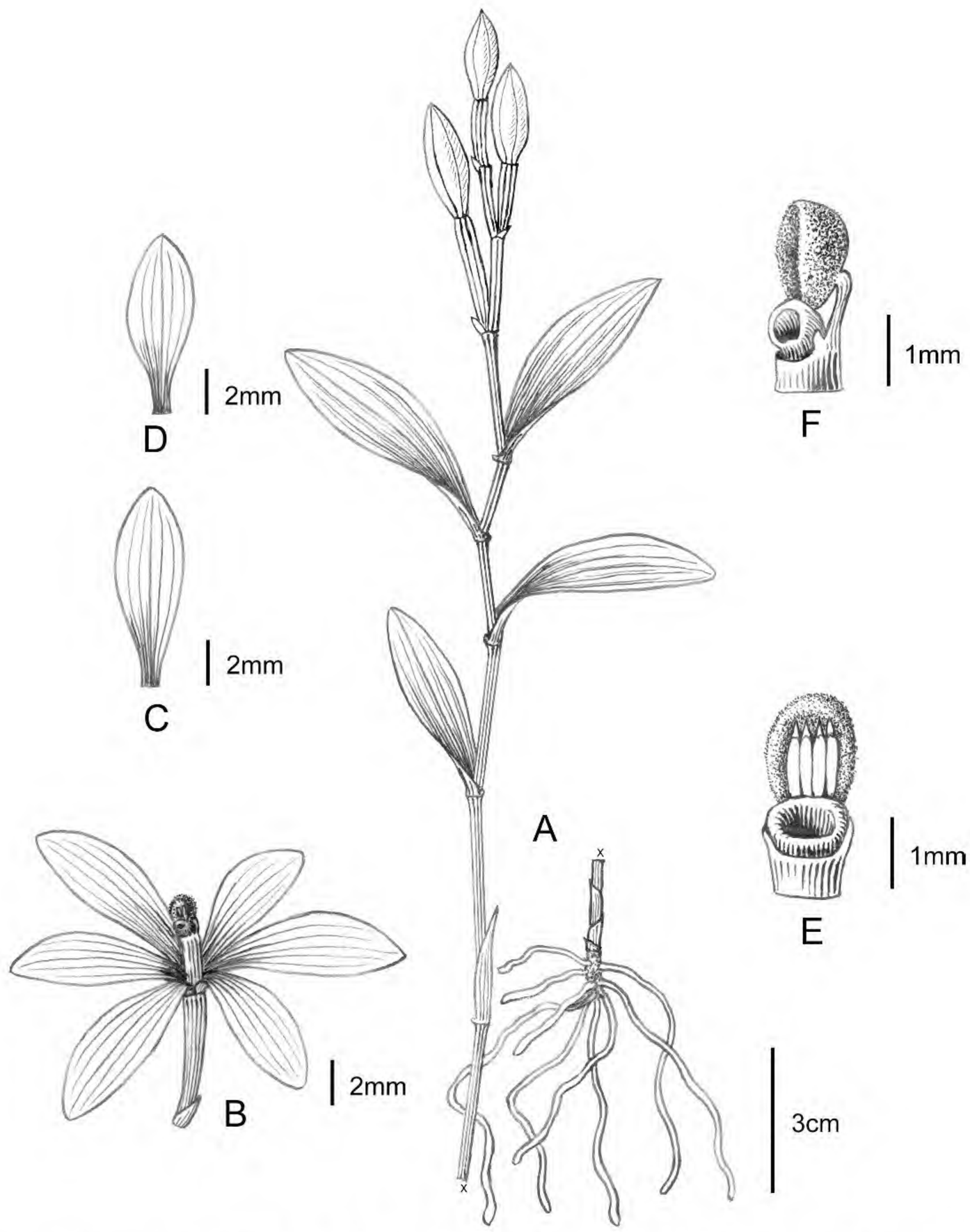

Figure 1. *Cephalanthera nanlingensis* A. Q. Hu & F. W. Xing. —A. Plant with flowers. —B. Flower. —C. Sepal. —D. Petal. —E. Ventral view of stigma. —F. Side view of stigma. Drawn from the holotype, *Ai-Qun Hu 46* (IBSC), by Han-Ping Yu.

Nanling Mountains, one at an altitude of ca. 700 m, the other at ca. 1500 m. Only a small population was found at 700 m, with less than 10 individuals, while four populations were found at 1500 m, which should have at least 30 individuals by our estimate. Based on comparison to other regions with similar vegetation and climate between 700 and 1500 m in the Nanling Mountains, this species should be expected to have more populations and individuals at other localities. Although the population size has increased each year we have observed it, according to the current knowledge of the species and using IUCN Red List criteria (IUCN, 2001), *C. nanlingensis* should tentatively be classified as Critically Endangered (CR).

Table 1. Comparison of *Cephalanthera nanlingensis*, *C. longifolia*, and *C. erecta*.

Characters	*C. nanlingensis*	*C. longifolia*	*C. erecta*
Stem	somewhat flexuous	erect	erect
Leaves (cm)	elliptic to lanceolate, 3.2–4.6 × 0.8–1.2	lanceolate, 2.5–13 × 0.5–2.5	elliptic to lanceolate, 2–8 × 0.7–2.3
Lowest bract (cm)	deltoid, 0.2–0.3	foliaceous, 5–13	foliaceous, 2–8
Perianth	subactinomorphic	zygomorphic	zygomorphic
Sepals (mm)	7–8 × 2–2.5	11–16 × 3.5–4.5	8–10 × 2.5–3.5
Petals (mm)	obovate, 5–6.5 × 1.7–2	obovate, 7–8 × ca. 4	elliptic to oblong, 7–7.5 × 2.5–3
Lip	similar to petals, without sac or spur, unlobed, glabrous	different from petals, saccate at base, 3-lobed, with 3 to 4 lamellae and papillae	different from petals, spurred, 3-lobed, with 3 lamellae and papillae

Phenology. *Cephalanthera nanlingensis* has been observed to flower in April and May. Fruits have not been seen.

Discussion. *Cephalanthera nanlingensis* is similar to *C. longifolia* and *C. erecta*. All three taxa have slender stems, plicate leaves, and white flowers. However, the latter two taxa have a foliaceous lowest bract, a zygomorphic perianth, and a 3-lobed lip with three or four lamellae that are densely papillose toward the apex. A close morphological comparison of the three taxa is given in Table 1.

Cephalanthera nanlingensis has a subactinomorphic perianth. Botanists are divided on treatment of this character, with some considering it a peloric form (Pridgeon et al., 2005), which should not be treated as a separate species; however, others consider this character to be a distinct and stable entity that merits definition at the species level (Chen, 1987). Regarding distribution, *C. longifolia* is not found in Guangdong Province. *Cephalanthera erecta* is recorded in northern Guangdong (Zhu, 1999), but has not been found to be sympatric with *C. nanlingensis*. Therefore, as *C. nanlingensis* has a separate distribution with distinct and stable populations, it should not be considered a peloric form of *C. erecta* or *C. longifolia*, and should instead be treated as a new species.

Additional specimens examined. CHINA. **Guangdong:** Ruyuan, Nanling Mtns., Baimakeng, 700 m, 25 Apr. 2007, *Huai-Zhen Tian & Xia-Lan Chen 631* (IBSC).

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Validation of the Name *Adiantum meishanianum* (Pteridaceae), a Species Endemic to Taiwan

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ABSTRACT. While investigating the fern called *Adiantum meishanianum* F. S. Hsu ex Y. C. Liu & W. L. Chiou (Pteridaceae), it was discovered that the name was not validly published because it had not appeared in an effectively published work. The name is validated herein; the holotype is deposited in HAST, and there are paratypes in TAIF, HAST, and SYSU.

Key words: *Adiantum*, IUCN Red List, Pteridaceae, Taiwan.

The name *Adiantum meishanianum* has not hitherto been validly published. The fern bearing this designation was first collected from Taiwan by Bi-Jao Wang on 30 October 1983 (*B. J. Wang 3025*, HAST) and "*Adiantum meishanianum*" was handwritten by Chen-Meng Kuo on the sheet without further validation. Later, Fei-Shuang Hsu collected plants of the same species in the same area of Meishan Village (Meishankou, type in sched., *Wang 3025*), Kaohsiung County, Taiwan, and treated them as a new species in his master's thesis (Hsu, 1993). Unfortunately, the publication of the name *Adiantum meishanianum* F. S. Hsu was not effective under Article 30.5 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006), because a name published in a thesis submitted to a university for the purpose of obtaining a degree is not considered an effective publication after 1 January 1953.

Moreover, even though Hsu's thesis provided the designation and image of the holotype, it lacked information on the designated herbarium or institute that contained the holotype specimen, which is contrary to the requirement of Article 37.6 for names published after 1 January 1990 (McNeill et al., 2006). As a result, the requirements for valid publication of the name were not met.

The present paper validates the name *Adiantum meishanianum* and designates a type specimen. As noted, the diagnosis provided by Hsu (1993) was never effectively published and is brief and in some parts erroneous. Therefore, we re-describe and present a full diagnosis and description of *A. meishanianum* herein.

Adiantum meishanianum F. S. Hsu ex Y. C. Liu & W. L. Chiou, sp. nov. TYPE: Taiwan. Kaohsiung, Meishankou, 30 Oct. 1983, *B. J. Wang 3025* (holotype, HAST). Figure 1.

Species nova ab *Adianto caudato* L. pinnarum paris imo stipite longiore (3–5 mm longo) atque frondis stipite longiore (ca. 10–20 cm longo) differt.

Rhizome short, erect to suberect, apex covered with scales; scales linear, to 4 mm, entire, bicolorous with a black center and brown margins; stipes ca. 10–20 cm, castaneous to blackish purple, lustrous, glabrous or sparsely hairy with multicellular hairs; scales on stipe like those on rhizome but concolorous brown. Lamina linear to lanceolate, pinnate, 10–50 × 3–6 cm; rachis sparsely hairy or glabrous, long attenuate at apex, leafless on distal part, and rooting at apex, occasionally secondarily prolonged; lateral pinnae largest at lamina base, lowermost pair of pinnae reflexed, distinctly stalked; stalks usually 3–5 mm, with ca. 60°–90° angle to rachis; pinnae numerous, 5 to 20 pairs, mostly dimidiate, usually 2–3 × 1–1.5 cm, rounded at apex, lower margin straight, softly herbaceous, glabrous on both surfaces; outer edge of pinnae subentire, crisped or lobed to about 1/3 of breadth of pinnae, sinuses narrow, lobes rounded to quadrangular, rounded to truncate at subentire or toothed apex. Sori at margin of pinnae, 5 to 16 per pinna, reflexed flaps 2–3 mm wide, glabrous.

Habitat, distribution, and IUCN Red List category. *Adiantum meishanianum* is an endemic species found growing on the edge of secondary forest. There is only one known population in Meishan Village (Meishankou), Kaohsiung, Taiwan. The area of distribution was approximately 40 × 20 m^2 and contained a population of less than 100 plants. According to IUCN Red List criteria, it should be considered Critically Endangered (CR B1a+2a; C2a[ii]) (IUCN, 2001).

Discussion. *Adiantum meishanianum* is similar to *A. caudatum* by the prolonged rachis bearing adventitious buds, but the two species differ by the sessile pinnae and dense indument on the rachis and

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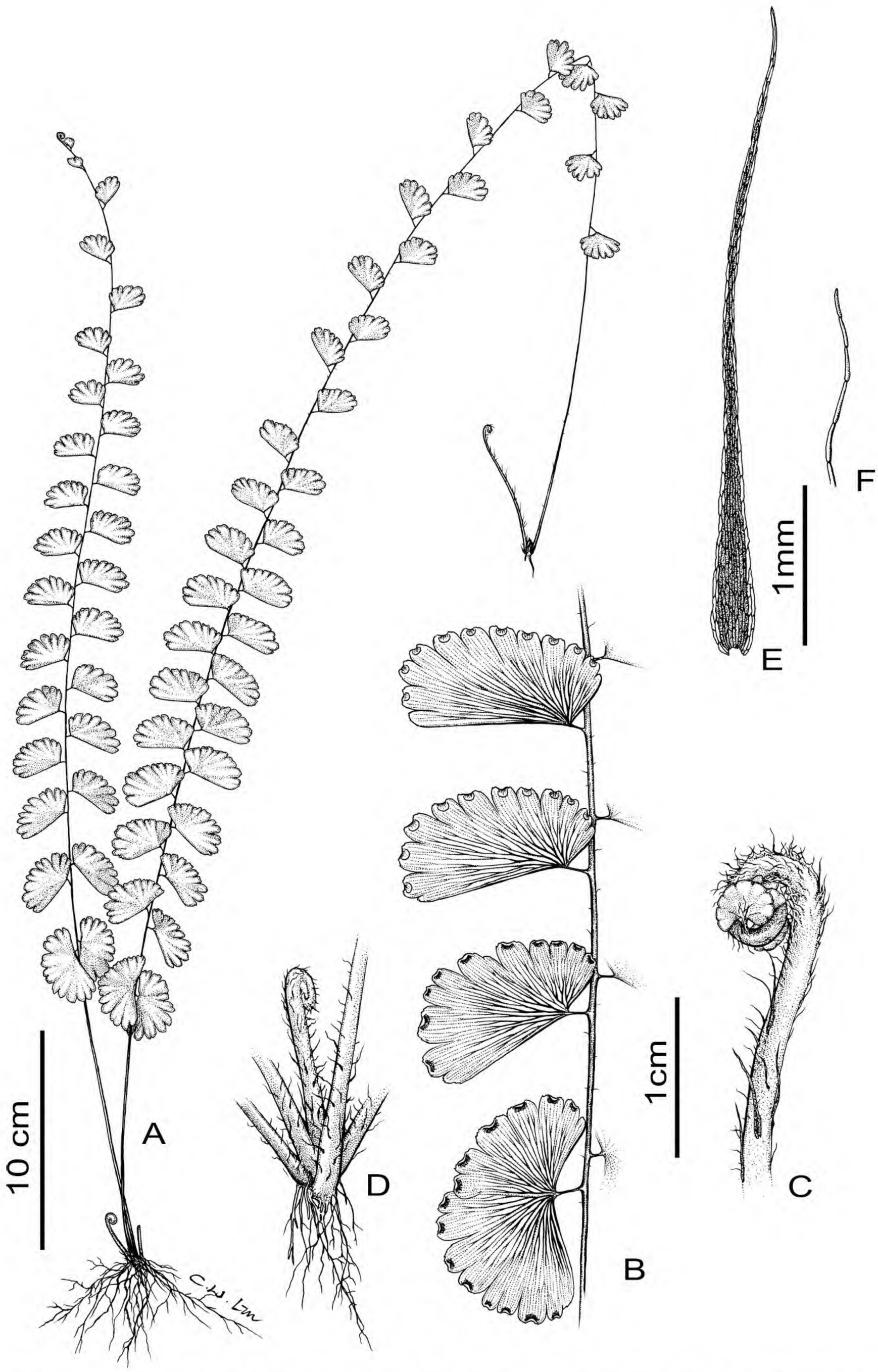

Figure 1. *Adiantum meishanianum* F. S. Hsu ex Y. C. Liu & W. L. Chiou. —A. Habit. —B. Proximal portion of the lamina, abaxial view. —C. Fiddlehead. —D. Stipe bases. —E. Rhizome scale. —F. Multicellular hair. Drawn from the holotype *B. J. Wang 3025* (HAST).

pinnae in *A. caudatum*. The new species is also similar to *A. philippense* L., recognized as a valid name prior to *A. lunulatum* Burman f. (Fraser-Jenkins & Verma, 2008), in the shape of the pinnae and in the pinnae being stalked, but differs by the sparsely hairy or glabrate rachis and by the shorter stalks of the pinnae (3–5 mm vs. 10–15 mm in *A. philippense*). Both *A. caudatum* and *A. philippense* are broadly

distributed in tropical and subtropical Asia. In Taiwan, they frequently occur in the low-elevation hills of southern Taiwan and have been found in the vicinity of the *A. meishanianum* population.

Bi-Jao Wang (1953–1992) made the first collection of this species. After his death, most of his specimens were deposited in the Herbarium of the Research Center for Biodiversity, Academia Sinica, Taipei (HAST), and the Herbarium of the Taiwan Forestry Research Institute, Taipei (TAIF). In memory of his contribution, we choose as holotype the specimen collected by him and named by C. M. Kuo on the specimen sheet.

Paratypes. TAIWAN. **Kaohsiung:** Meishan Village, 17 Mar. 2007, *Y. C. Liu, Y. M. Huang & W. L. Chiou 5006* (SYSU, TAIF), 3 Oct. 1992, *F. S. Hsu 2114* (HAST).

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A New Species of *Meliosma* (Sabiaceae) from Southeastern Brazil and Notes on the Genus

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Abstract. *Meliosma chartacea* Lombardi (Sabiaceae), a new species from southeastern Brazil, is described from Minas Gerais and Espírito Santo. It is characterized by its entire internal petals, very short petiole (generally less than 1 cm), brochidodromous venation, and entire leaf margin. A key to determine the species from southeastern Brazil is presented. Lectotypes and new synonyms are proposed for formerly described Brazilian species: *M. sellowii* Urban and *M. itatiaiae* Urban.

Resumo. *Meliosma chartacea* Lombardi (Sabiaceae), uma nova espécie sudeste do Brasil é descrita para Minas Gerais e Espírito Santo, esta espécie é caracterizada pelas pétalas internas inteiras, pecíolos muito curtos (geralmente com menos do que 1 cm), venação broquidódroma e pela margem inteira das folhas. É apresentada uma chave para a determinação das espécies do sudeste do Brasil. Lectótipos e novos sinônimos são propostos para as espécies brasileiras anteriormente descritas: *M. sellowii* Urban e *M. itatiaiae* Urban.

Key words: Brazil, IUCN Red List, *Meliosma*, Sabiaceae, South America.

The Sabiaceae (including the Meliosmaceae) currently include three genera and between 80 and 90 species (Arbeláez, 2004; Aymard & Cuello, 2005) distributed in the tropical and subtropical areas of Asia and the Americas (Kubitzki, 2004). Two genera occur in the Neotropics: *Ophiocaryon* Endlicher, restricted to the rainforests of northeastern South America (Barneby, 1972; Aymard & Cuello, 2005; Aymard C. & Daly, 2006), and *Meliosma* Blume, an amphi-Pacific genus disjunct between Southeast Asia and tropical America, and found mostly south of Central America and in the tropical Andes.

Meliosma is traditionally subdivided into two subgenera, *Meliosma* and *Kingsboroughia* (Liebermann) Beusekom (Van Beusekom, 1971). The former includes sections *Meliosma* and *Lorenzanea* (Liebermann) Beusekom, while the latter is divided into sections *Kingsboroughia* and *Hendersonia* Beusekom. All Neotropical species are included in section *Lorenzanea*, except *M. alba* (Schlechtendal) Walpers, disjunct between southern Mexico and southeastern Asia, which is placed in section *Kingsboroughia* (Van Beusekom, 1971).

The most recent taxonomic study of the genus, although incomplete, was by Van Beusekom (1971), who revised all the taxa of the genus with the exception of the exclusively American section *Lorenzanea*. He recognized 15 species in the three sections and suggested the unstudied American section would not exceed 10 species.

The most recent treatment of Neotropical *Meliosma* was carried out by Urban (1900), who described 17 species: 11 from Mexico, Central America, and the Caribbean islands; one from Colombia; and five from Brazil. Since then, 40 additional new species from South America have been described (Kuhlmann, 1935; Lasser, 1943; Cuatrecasas, 1949, 1955, 1959, 1988; Steyermark, 1952, 1953, 1966; Cuatrecasas & Idrobo, 1955, 1988; Steyermark & Maguire, 1967; Gentry, 1986, 1992; Idrobo, 1988; Steyermark & Gentry, 1992; Aymard C. & Cuello A., 1994; Arbeláez, 2004; Cornejo & Bonifaz, 2006), but only one new species has been described from Brazil; this species is restricted to the Amazon Basin (Kuhlmann, 1935).

This increase in species number is attributed to the common local endemism that occurs in the family (Arbeláez, 2004) and is reported by Van Beusekom (1971) as a consequence of the pollination mechanism of the minute flowers, which eject the pollen on the thecae in a single burst at anthesis. This probably entails a great rate of geitonogamy and consequently the establishment of local morphological variations (Van Beusekom, 1971).

The small number of new taxa described from Brazil is certainly due to insufficient collections, which is partially justified by the difficulty of collecting flowering specimens (Arbeláez, 2004) and the absence of taxonomists working on this family in Brazil. As shown by the floristic surveys in other South American countries (Cuatrecasas & Idrobo, 1955; Steyermark & Gentry, 1992; Arbeláez, 2004), additional botanical exploration always reveals many unknown species.

While starting a revisionary study of the family for Brazil, a very preliminary look at the meager collections deposited in principal herbaria in southeastern Brazil has revealed several undescribed *Meliosma* species, clearly distinct from those described by Urban (1895, 1900). Of these new species, thus far only one has sufficient specimens to allow a proper description, which is presented here.

Meliosma chartacea Lombardi, sp. nov. TYPE: BRAZIL. Minas Gerais: Santa Maria do Salto, Faz. Duas Barras, 16°24′12.1–29.5″S, 40°02′36.6–33.7″W, 760–850 m, 25 Aug. 2003, *J. A. Lombardi 5537, J. R. Stehmann, R. C. Mota & L. G. Temponi* (holotype, BHCB; isotypes, HRCB, MO). Figures 1, 2.

Haec species *Meliosmae itatiaiae* Urban quoad laminam foliarem magnam chartaceam spathulatam et petiolum interdum ad pulvinum redactum similis, sed ab ea foliis marginibus integris venatione brochidodroma et petalis internis apice integris differt.

Trees, treelets, or shrubs, 5–20 m tall; branches subterete, shiny, furrowed, lenticellate, soon corky, shoot apex puberulous, with very short and inconspicuous trichomes, or sparsely strigose, glabrescent; axillary buds strigose. Leaves alternate to suboppposite; petioles (0.4–)0.7–1(–1.4) cm, cylindrical, swollen and pulvinus-like, drying cracked and scaly; blades (13.6–)26–31.6(–61) × (4.2–)7–10(–12.5) cm, spatulate; base cuneate-rounded, apex acute or acuminate; margin entire, thickened by a fimbrial vein; blade chartaceous, drying brown, glabrous on both sides except for very inconspicuous and sparse short trichomes along the primary vein abaxially; venation brochidodromous, primary vein lenticellate, immersed adaxially, prominent abaxially, secondary veins flat and light brown adaxially, prominent abaxially, gradually arched toward margin, tertiary veins and veinlets very lightly prominent, sometimes light brown adaxially, flat and light brown abaxially. Inflorescence a leafy terminal or subterminal panicle, 2 to 3× branched, ca. 29–42 × (8–)18–28 cm; axes lenticellate, from sparsely puberulous at base to densely puberulous at apex, glabrescent, corky on infructescence, with leafy and scale-like bracts and abortive strigose vegetative buds, branches sparsely lenticellate, densely puberulous or glabrous except at apex; leafy bracts occasional, ca. 6.2 × 2.2 cm, sessile or short petiolate (ca. 0.5 cm), elliptic, apex acute, base rounded; scale-like bracts 0.5–3 mm, aciculate to triangulate, strigose or sparsely pilose on the margin; pedicels absent; bracteoles 2 to 3, 0.5–0.8 × 0.7–1 mm, triangular, minutely ciliate, very similar to sepals. Flower buds ca. 2 mm diam., spherical, green, opened flowers not seen; sepals 5, 0.8–1 × 0.8–1.2 mm, triangulate, ± equal in size or the outer slightly smaller, carnose, ciliolate, otherwise glabrous; petals 5, unequal, with 3 larger outer petals and 2 smaller inner ones, the outer petals oblate, cucullate, carnose, ciliolate, otherwise glabrous, outermost 1.3–1.5 × 1.1–1.6 mm, the internal two 1.4–1.8 × 1.3–2; inner petals 1.4–1.5 × 0.4–0.5 mm, reduced, papery, elliptic, apex acute and ciliolate; fertile stamens 2, ca. 1 mm, opposite inner petals and adnate to ca. 1/4 of their length, the filaments ligulate, incurved at apex, anthers ca. 0.7 × 0.9 mm, thecae suborbicular, transversely dehiscent before anthesis, separate and subtended by the thickened connective; staminodes 3, ca. 1 × 0.7 mm, opposite to outer petals and partially adnate to them, irregular, asymmetric, with 1 or 2 hemispheric cup-like depressions in the apex, these cover the adjacent thecae of the fertile stamen while inside the bud; disk consisting of 5 vestigial teeth, 0.1–0.2 mm; pistil 0.8–1.4 mm, subovate, laterally flattened, 2-locular, with 2 ovules in each locule, style 0.3–0.4 mm, cylindrical, stigmas minute, 2-lobed. Immature (?) drupes (1.7–)2–2.3 (–2.8) × 1.6–1.9 cm, asymmetric, green to light green, drying verrucose and brown, endocarp 1.4–1.7 × 1.5–1.6 cm, subspherical, smooth, cream; seeds not seen.

Distribution, habitat, and IUCN Red List category. *Meliosma chartacea* is restricted to the rainforests of the Brazilian Atlantic Range and collected in five localities in the states of Minas Gerais, Espírito Santo, and São Paulo, where it occurs at altitudes of 400–850 m. It has been reported in disturbed remnants of wet forest, on forested slopes, and along streams. This species has also been reported to occur inside different conservation areas, three in Santa Teresa Municipality, Espírito Santo—the Santa Lúcia Biological Station (ca. 440 ha.), the Augusto Ruschi Biological Reserve (3598.41 ha.), and the São Lourenço Biological Station (22 ha.) (Mendes & Padovan, 2000); and two in São Paulo State—the Jurupará State Park (26,250 ha.) and the Serra do Mar–Núcleo Pedro de Toledo State Park (55,462 ha.). It is thus protected, at least in this part of its distribution; nonetheless, it is considered Endangered (EN) according to IUCN Red List criteria (IUCN, 2001) because its area of occurrence is less than 5000 km^2, it is known to occur only at five locations, and a continuing decline of its area of occupancy is inferred for habitat fragmentation.

Phenology. Collected with flowers in August, December, and January, and with fruits from March to May and July to October.

Etymology. The specific epithet of this species refers to the chartaceous texture of its leaves.

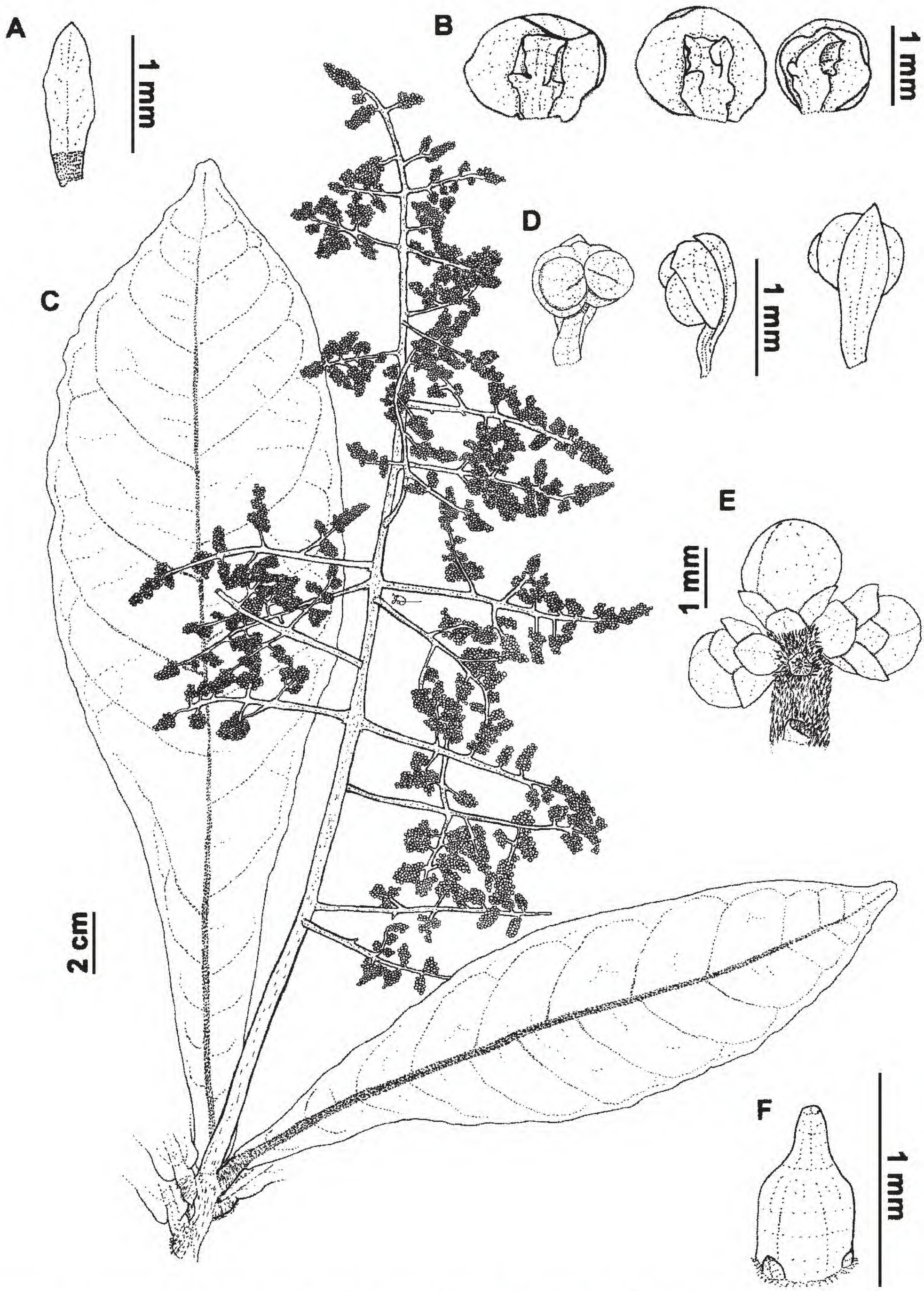

Figure 1. *Meliosma chartacea* Lombardi. —A. Inner petal. —B. Outer petals with adnate staminodes. —C. Branch with leaves and inflorescence. —D. Stamen with adnate inner petal: ventral, lateral, and dorsal views. —E. Apex of inflorescence branch with flower buds and subjacent bracteoles, one bud missing. —F. Pistil with two teeth of the disc. Drawn by the author from the holotype *Lombardi 5537* (BHCB).

Figure 2. *Meliosma chartacea* Lombardi showing immature fruits. Photo by the author from the holotype *Lombardi 5537* (BHCB).

Vernacular. Unknown.

Discussion. *Meliosma chartacea* resembles *M. itatiaiae* because of its large spatulate and short-petiolate leaves. Nevertheless, *M. itatiaiae* has conspicuous serrate leaf margins (vs. entire margin in *M. chartacea*), semicraspedodromous venation (vs. brochidodromous), and a bifid inner petal (vs. entire).

The "disk" is composed of five reduced teeth at the ovary base. It was seen in mature buds from the holotype, but was not observed in the flowered paratypes with younger buds. In some specimens of *Meliosma sellowii*, the disc was not found in bud, while in others it was more or less defined. Although, herein, this structure receives the name it is given in the literature (Urban 1895, 1900; Van Beusekom, 1971), some doubts remain about its nature and possible functions in the flower, if any at all, because of the absence of anatomical and developmental studies.

The specimens collected in Santa Teresa, Espírito Santo; in Santa Maria do Salto, Minas Gerais; and in Ibiúna, São Paulo, showed different flowering periods (December–January in the first, and August for the other two). These discrepancies could be the result of insufficient sampling or may reflect a real variation of phenology. The fruits apparently remain on the plant for a long time (Fig. 2). No variation in fruit color was observed in the two different collections of the species by the author, and no other coloration is reported in the collection labels of the paratypes.

Paratypes. BRAZIL. **Espírito Santo:** Santa Teresa, 30 Jan. 1986, *W. Boone 1068* (HRCB, MBML); Santa Teresa, Nova Lombardia, Res. Biol. Augusto Ruschi, 11 Dec. 2001, *L. Kollmann 5183* (HRCB, MBML); Santa Teresa, São Lourenço, Mata Fria, 2 Dec. 1998, *L. Kollmann 1167* (HRCB, MBML); Santa Teresa, São Lourenço, Est. Biol. de São Lourenço, 21 Aug. 2001, *L. Kollmann 4383* (HRCB, MBML); Santa Teresa, Est. Biol. de Santa Lúcia, 19 July 1984, *W. Boone 262* (HRCB, MBML); 24 Mar. 1988, *H. Q. Boudet-Fernandes 2439* (HRCB, MBML); 30 Mar. 1999, *L. Kollmann 2322* (HRCB, MBML); 26 May 1999, *Lopes 749* (HRCB, MBML); 28 Aug. 1993, *L. D. Thomaz 962* (MBML); 19 Apr. 1994, *L. D. Thomaz 1664* (MBML); 27 July 1993, *L. D. Thomaz 1823* (MBML, Herbarium of the Universidade Federal do Espírito Santo). **Minas Gerais:** Santa Maria do Salto, Fazenda Duas Barras, ca. 16°24′S, 40°03′W, 10 Mar. 2004, *J. A. Lombardi 5972* (BHCB). **São Paulo:** Ibiúna, Parque Est. de Jurupará, caminho da Faz. Tucano, 11 Aug. 1995, *O. T. Aguilar & J. A. Pastore* (SPSF); Miracatu, Parque Est. de Jurupará, estrada do Mono, 6 Sep. 1995, *J. B. Baitello & O. T. Aguilar 805* (SPF, SPSF); Peruíbe, Parque Est. da Serra do Mar, Núcleo Pedro de Toledo, trilha do Rio do Ouro, 13 Mar. 2005, *R. Cielo-Filho 378* (HRCB, SPSF).

Key to the Described Species of *Meliosma* in Southeastern Brazil

1a. Leaves spatulate, large, (13.6–)26–31.6(–61) × (4.2–)7–14.5(–20.5) cm, petiole relatively short, sometimes swollen and without distinct pulvinate and canaliculate parts.
  2a. Inner petals bifid, lobes divergent, conspicuous, venation semicraspedodromous, leaf margin conspicuously serrate . . . . . *M. itatiaiae*
  2b. Inner petals entire, venation brochidodromous, leaf margin entire . . . . . *M. chartacea*
1b. Leaves elliptic to obovate, (2.9–)3.5–15.7(–21.2) × (0.9–)1.6–5.4(–6.1) cm, conspicuously petiolated, petiole having distinct pulvinate and canaliculate parts . . . . . *M. sellowii*

Nomenclatural Notes

Meliosma itatiaiae Urban, Symb. Antill. 1(3): 510. 1900. TYPE: Brazil. Minas Gerais: Itatiaia, Fazenda do Taquaral, 26 Sep. 1874, *Glaziou 7565* (lectotype, designated here, P [3 sheets, 2 of these pictured in the same F 35982]; duplicates, F [fragm.], K).

Discussion. The holotype of *Meliosma itatiaiae*, pictured in F 13375, was destroyed in the Botanical Museum Berlin-Dahlem Herbarium (B) (Hiepko, 1987), and the name therefore requires lectotypification. The proposed lectotype was chosen because it is more complete and the three sheets are clearly part of the same gathering, including cauline large leaves on one sheet and inflorescence parts on the other two, so that the three sheets comprise the lectotype (cf. Art. 8.3 of the *International Code of Botanical Nomenclature* [McNeill et al., 2006]).

Meliosma itatiaiae has been reported in the Mantiqueira Range, on the border between Rio de Janeiro, Minas Gerais, and São Paulo states. The only collection outside this range (Igaratá) is only ca. 150 km south from the range outskirts.

Selected specimens examined. BRAZIL. **Rio de Janeiro:** Engenheiro Passos, *Hatschbach 45530* (US); Itatiaia, *Altamiro & Walter 139* (RB), *Campos Porto 821* (RB), *Glaziou*

6697 (K, P), *Kuhlmann s.n.* (RB 258917), *Silveira s.n.* (RB 2233); Rezende, *Martinelli 3258* (K, NY). **São Paulo:** Piquete, *Arzola & Sene 703* (SPSF); Santa Isabel, Igaratá, *M. Kuhlmann 2550* (SP), *M. Kuhlmann s.n.* (SP 36290), *M. Kuhlmann s.n.* (SP 66057).

Meliosma sellowii Urban, Ber. Deutsch. Bot. Ges. 13: 212. 1895. TYPE: Brazil. s. loc., *Sellow 2205 c. 2217* (holotype, B not seen [image seen; another sheet was destroyed = F 13377]; isotype, K).

Meliosma sinuata Urban, Ber. Deutsch. Bot. Ges. 13: 212. 1895. TYPE: Brazil. Rio de Janeiro: prope Petrópolis, 20 Nov. 1887, *Glaziou 16707* (lectotype, designated here, P; isotype, K).

Meliosma brasiliensis Urban, Ber. Deutsch. Bot. Ges. 13: 216. 1895. TYPE: Brazil. Rio de Janeiro: Alto Macahé, 1500 m, 23 Nov. 1888, *Glaziou 17729* (lectotype, designated here, P [F 35984]; duplicates, F [fragm.], P, US).

Meliosma glaziovii Urban, Symb. Antill. 1(3): 508. 1900. TYPE: Brazil. Rio de Janeiro: entre Nova Friburgo et le Alto [Macahé], 9 Oct. 1890, *Glaziou 12131* (lectotype, designated here, P [F 35983]; duplicates, F [fragm.], K, P, US).

Discussion. The holotype of *Meliosma sinuata* (pictured in F 13378), the syntypes of *M. brasiliensis* (*Glaziou 17729* [F 13372] and *Glaziou 8099*), and the syntypes of *M. glaziovii* (*Glaziou 12131* [F 13374] and *Glaziou 19587*) were destroyed in the Botanical Museum Berlin-Dahlem Herbarium (B) (Hiepko, 1987), and the names therefore require lectotypification.

For lectotypification of *Meliosma brasiliensis*, the isosyntype *Glaziou 8099* (Rio de Janeiro, Corcovado, Cova da Onça, 23 Nov. 1875 [F, K, P]) was also considered, but *Glaziou 17729* was chosen as the more complete specimen. Likewise, for lectotypification of *M. glaziovii*, the isosyntype *Glaziou 19587* (Alto Macahé, 5 Oct. 1891 [K, P]) was considered, but *Glaziou 12131* was selected as more representative.

All the species described by Urban (1895, 1900) and here proposed as synonyms of *Meliosma sellowii* present slight variations of leaf shape and margin, indument, and inner petal apex. Intermediate states of these characteristics were seen in the many specimens collected in Santa Teresa, Espírito Santo State; Camanducaia, Minas Gerais State; and in the other localities represented by unique collections. Among the available names by priority, *M. sellowii* was the chosen name. It is the most frequently seen name on herbarium labels and in floristic and phytosociological studies (e.g., Jung-Mendaçolli, 1996; Kurtz & Araújo, 2000; Jurinitz & Jarenkow, 2003; França & Stehmann, 2004).

Selected specimens examined. BRAZIL. **Espírito Santo:** Santa Teresa, Est. Biol. de Santa Lúcia, *Bausen 21* (HRCB, MBML); Domingos Martins, *Hatschbach & Silva 48663* (CEPEC, MBM, NY, US). **Minas Gerais:** Camanducaia, *França 222* (BHCB, HRCB). **Paraná:** Antonina, *Hatschbach 72720* (BHCB, MBM); Castro, *Klein & Leite 12023* (RB); Guaratuba, *J. M. Silva & Saldanha 1776* (BHCB, MBM); Morretes, *J. M. Silva 1212* (BHCB, MBM). **Rio de Janeiro:** Pedra do Cônego, à Nova Friburgo, *Glaziou 12401* (P [F 13374]); Rio de Janeiro, *Kuhlmann s.n.* (RB 24391); Cachoeiras de Macacu, *Kurtz s.n.* (RB 328374). **Santa Catarina:** Ibirama, *L. B. Smith & Klein 7543* (F, K, NY, P, RB, US); Porto União, *Klein & Smith 10827* (M); Rio do Sul, *Reitz & Klein 7307* (K, M, NY, US). **São Paulo:** Cananéia, Ilha do Cardoso, *Castro 16* (HRCB); Sete Barras, Parque Est. de Carlos Botelho, *Farias et al. 707* (BHCB, ESA); Jundiaí, Res. Biol. Mun. da Serra do Japi, *Lombardi 6468* (HRCB); Pariquera-Açu, *Udulutsch et al. 2613* (HRCB).

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Cnidoscolus monicanus (Euphorbiaceae), an Endemic New Species of Laticiferous, Non-Stinging Spurge Nettle from Western Mexico

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Abstract. *Cnidoscolus monicanus* J. A. Lomelí, Sahagún & V. W. Steinmann (Euphorbiaceae), endemic to western Mexico, is described and illustrated. This new species belongs to *Cnidoscolus* Pohl sect. *Calyptrosolen* (Müller Argoviensis ex Pax) Pax & K. Hoffmann and is closely allied to *C. elasticus* Lundell and *C. tepiquensis* (Costantin & Gallaud) McVaugh. We provide an identification key to the *C. tepiquensis* complex. These species share an arborescent and little or non-urticating habit at maturity, inflorescences that are often unisexual, and large seeds. We hypothesize that these species constitute a monophyletic group within section *Calyptrosolen*. *Cnidoscolus monicanus* is characterized by the following combination of characters: tree with grayish non-exfoliating bark and verticillate branching, petioles with two discrete glands projecting outward from the epidermis, leaf laminas (16–)20–41(–60) × (25–)36–67(–75) cm, leaf margins entire or with a few obscure to rarely caudate teeth, staminate flowers with a pubescent zone on the staminal column 3–4 mm long, pistillate flowers with a tomentulose perianth, a tomentose to sericeous ovary, peduncles of the pistillate infructescence 1.7–5 cm long, capsule with distal ribs and an acute apex, pedicels 5–20 mm long, and seeds 24–32 mm long. The new species occurs at elevations of 750–1640 m in tropical deciduous and semideciduous forest. We applied the Method for Evaluation of Risk Extinction for Wild Species in Mexico (MER) to estimate the conservation status of *C. monicanus*, and we concluded that it is threatened. We also evaluated the new species using applicable IUCN criteria and found it to be Endangered (EN).

Resumen. Se describe e ilustra *Cnidoscolus monicanus* J. A. Lomelí, Sahagún & V. W. Steinmann (Euphorbiaceae), especie nueva para la ciencia endémica del occidente de México. La nueva especie pertenece a *Cnidoscolus* sección *Calyptrosolen* (Müller Argoviensis ex Pax) Pax & K. Hoffmann y está cercanamente relacionada con *C. elasticus* Lundell y con *C. tepiquensis* (Costantin & Gallaud) McVaugh. Se proporciona una clave de identificación para las especies del complejo *C. tepiquensis*. Estas especies comparten el hábito arborescente poco o nada urticante en la madurez, las inflorescencias por lo general unisexuales y las grandes dimensiones de las semillas. Se hipotetiza que estos taxa forman un grupo monofilético dentro de la sección *Calyptrosolen*. *Cnidoscolus monicanus* se caracteriza por la combinación de los siguientes caracteres: árbol con corteza grisácea no exfoliante, ramificación verticilada, pecíolo con dos glándulas discretas, hoja con lámina de (16–)20–41(–60) × (25–)36–67(–75) cm, margen foliar entero o con pocos dientes obscuros a raramente caudados, flores estaminadas con zona pubescente de la columna estaminal de 3–4 mm de largo, flores pistiladas con perianto tomentuloso, ovario tomentoso a seríceo, pedúnculo de la infructescencia pistilada de 1.7–5 cm de largo, cápsula con costillas distales y ápice agudo, pedicelo de 5–20 mm de largo, semillas 24–32 mm de largo. Crece a altitudes de 750–1640 m en bosque tropical caducifolio y subcaducifolio. Se aplicó el Método de Evaluación del Riesgo de Extinción de las Especies Silvestres en México (MER) para estimar el estado de conservación de *C. monicanus* y se concluye que está amenazada. También se evaluó la nueva especie con los criterios aplicables de la UICN y se encontró que está En Peligro (EN).

Key words: *Cnidoscolus*, Euphorbiaceae, IUCN Red List, Jalisco, MER evaluation, Michoacán, western Mexico.

During the examination of unidentified material of Euphorbiaceae at the herbarium of the Instituto de Ecología–Centro Regional del Bajío (IEB), specimens

of an interesting species of *Cnidoscolus* Pohl came to light. The same species was also independently collected by botanists at the Universidad Autónoma de Guadalajara during their explorations in the southwestern region of the Mexican state of Michoacán between 1998 and 2002. The material, after careful study, appears to belong to an undescribed species and is herein described as new to science. The new species is currently known from only two municipalities of Michoacán and from a location near Casimiro Castillo, in the adjacent state of Jalisco.

The genus *Cnidoscolus* is characterized by stinging epidermal hairs, glands on the distal part of the petiole, white pith, a single-whorled white perianth, and a style with three to five dichotomous branches ending in slender tips. In addition, the pistillate flowers develop rudimentary stamens and the staminate flowers have filiform sterile processes and a stipitate glandular disc that originates above the base of the staminal column (McVaugh, 1944).

Section *Calyptrosolen* (Müller Argoviensis ex Pax) Pax & K. Hoffmann includes the species of *Cnidoscolus* with palmately lobed leaves, single or paired petiolar glands, monadelphous stamens in two verticils, and relatively floriferous cymes (McVaugh, 1944). This section comprises about 40 species and reaches its center of diversity in Mexico (Breckon, 1975). The objective of this study is to describe, illustrate, and estimate the conservation status of *C. monicanus*, a new species belonging to section *Calyptrosolen*.

Material and Methods

Four trips were made to southwestern Michoacán in western Mexico to collect material and to take photographs of the undescribed species. An additional trip was made to the mountains of southern Sinaloa to collect and study *Cnidoscolus tepiquensis* (Costantin & Gallaud) McVaugh and *C. elasticus* Lundell, two apparently closely related species. Living plants of *C. tepiquensis* and *C. monicanus* are kept in cultivation in the "Jorge Victor Eller T." Botanical Garden at the Universidad Autónoma de Guadalajara, and these were used to make the observations that support this study and to prepare the identification keys included below. Data from herbarium specimens housed at GUADA, IBUG, and IEB were also used. The Vascular Plant Types Catalog of the New York Botanical Garden, available at <http://sciweb.nybg.org/Science2/hcol/vasc/index.asp>, provided important information. Terminology and limits of plant structure measurements follow the criteria of Breckon (1975). Measurement ranges in Table 1 for *C. elasticus* and *C. tepiquensis* were partly based on the descriptions of Breckon (1975). To estimate the conservation status of *C. monicanus*, we used the Method for Evaluation of Extinction Risk for Wild Species in Mexico (MER) (SEMARNAT, 2002; Olson et al., 2005) and the criteria of the International Union for Conservation of Nature and Natural Resources (IUCN, 2001). MER evaluations are required by law in Mexico for native species to receive legal protection.

Cnidoscolus monicanus J. A. Lomelí, Sahagún & V. W. Steinmann, sp. nov. TYPE: Mexico. Michoacán: Mun. Chinicuila, Rancho El Tejón, on Aquila–Coalcomán hwy., 1640 m, 7 June 2002 (♀ fl.), *E. Sahagún 2396 with J. A. Lomelí & S. Parra* (holotype, GUADA; isotypes, IEB, MEXU, MO). Figure 1.

Arbor 7–20 m alta, maturitate quasi tote inermis, trunci cortice griseo vel ferrugineo non exfoliato, ramificatione verticillata, ramulis monomorphis medulla farcta. Folium petiolo glandibus geminatis discretis praedito; lamina (16–)20–41(–60) × (25–)36–67(–75) cm lata, margine integro vel dentibus paucis obscuris vel raro caudatis munito. Flos masculus columnae staminalis zona pubescente 3–4 mm longa; flos femineus perianthio adaxialiter tomentuloso, ovario tomentoso usque sericeo. Infructescentia feminea pedunculo 1.7–5 cm longo insidens, pedicellis 5–20 mm longis. Capsula distaliter costata et apice acuta; seminibus 24–32 mm longis.

Drought deciduous tree 7–20 m tall, trunk ca. 30–50 cm DBH, urticating when young, virtually unarmed at maturity; bark light gray to light brown or reddish, non-exfoliating, slightly fissured with vertical, light-colored, spindle-shaped fissures and round ferruginous lenticels; latex white, copious; stem erect, monomorphic, with verticillate branching; current year branchlets 11–23 mm thick, fleshy, lustrous, glabrous, dark green with straw-colored lenticels; second year branchlets gray to brown, non-exfoliating, the pith solid even after drying. Young leaves with petiole tomentose to tomentulose; lamina yellowish green, depressed, palmatisect, with 5 to 7 lanceolate to elliptic lobes; margin entire, apex long caudate, tomentose on adaxial surface, the tomentum light brown, obscuring the veins and the epidermis, abaxial surface tomentulose, especially on the sides of the veins; mature leaves with stipules caducous, 4–8 mm, deltoid, green, abaxial surface glabrous, papillate-glandular with ca. 12 to 22 white glands, the apex acuminate, 2–3 mm, petiole terete, (14–)22–55 cm × 7–10 mm thick in fresh material, glabrous except sometimes for a longitudinal line of acicular slightly stinging trichomes on the adaxial surface, glands 2, discrete, projecting outward from the epidermis, cushion-like, 1–2 mm; lamina palmately parted to

Table 1. Principal differences between *Cnidoscolus monicanus* and closely related species.

Character	*C. elasticus*	*C. monicanus*	*C. tepiquensis*
Elevation (m)	(500–)900–1600	750–1640	30–900
Branching	non-verticillate	verticillate	verticillate
Trunk bark	exfoliating, reddish	non-exfoliating, grayish to reddish	non-exfoliating, grayish
Stipules, abaxial surface	tomentose	glabrous	tomentose
Glands	2, discrete, projecting outward from the epidermis, cushion-like	2, discrete, projecting outward from the epidermis, cushion-like	1, U-shaped, flush with the epidermis
Lamina, length (cm)	15	(16–)20–41(–60)	(15–)19–49
Lamina, width (cm)	25	(25–)36–67(–75)	(18–)24–56
Lamina, primary veins	5 or 7	7 or 9	7 or 9
Lamina, marginal teeth*	0 to 9(26), obscure to rarely short caudate	0 to 3(6), obscure to rarely caudate	20 to 28, caudate
Staminate flower bud	strongly pyriform	conspicuously swollen about the disc, narrow-clavate above	conspicuously swollen about the disc, narrow-clavate above
Staminate flower. Pedicel length after abscission (mm)	< 0.5	> 1.5	≤ 1
Staminate flower. Length of pubescent zone (mm)	(1.5–)3.5–3.8	3–4	1–2
Pistillate perianth indumentum	tomentose, with few stinging hairs	tomentulose, not stinging	glabrous
Ovary, length (mm)	3–6	5–7.5	3.5–4
Ovary indumentum	sericeous	tomentose to sericeous	glabrous or with few adpressed hairs at base
Infructescence, length of peduncle (cm)	5–13	1.7–5	20.5–23.5
Capsule, length of pedicel (mm)	0–1.3	5–20	6–40
Capsule, apex at maturity	acute	acute	rounded
Pericarp	without ribs	with ribs	without ribs
Columella, length (mm)	23	30–35	27–29
Seeds, length (mm)	17–23	24–32	22–27

* The primary veins extending at the apices of the lobes were not considered in the count.

palmatisect, with 5 to 7 lobes and 7 to 9 primary yellowish palmate veins, (16–)20–41(–60) × (25–)36–67(–75) cm, the lobes caudate at the apex, the apical lobe spatulate to obovate, 15–24 cm long, 2.8–7.2 cm wide at base, and 7–13 cm wide at the widest point, the apex 2.6–4 cm, distal lateral lobes spatulate to obovate, 16–25 × 6.5–7 cm, proximal lateral lobes obovate to oblanceolate, 12–20 cm, base cordate, glabrous or with a few stinging hairs, the basal sinus 3–3.5 cm deep, margin entire except for 0 to 3(6) obscure to rarely caudate teeth distributed among the lobes, adaxial leaf surface hirtellous, slightly stinging, abaxial leaf surface hirsute. Dichasial cymes 2 to 4, subapical, commonly unisexual, only staminate in juvenile treelets, staminate, pistillate, or mixed in adult trees; staminate inflorescences multiflorous, up to 5× dichotomous and with a ringed scar between each dichotomy, the scar made from the early abortive immature pistillate flowers; pistillate inflorescences usually with a single dichotomy, pauciflorous (with 2 to 6 flowers), appearing umbellate; mixed inflorescences with 4 to 6 dichotomous branches, the pistillate flowers solitary at the base of proximal dichotomies and the staminate flowers in the distal dichotomies, 30 to 96 per inflorescence; in all cases the peduncle 2.2–8 cm, tomentose to tomentulose to glabrescent, the tomentum brown to dull white; bracts 3–8 mm, lanceolate, with a small basal lobe on each side, tomentose on both surfaces; perianth of the staminate flowers white, adaxial surface glabrous, abaxial surface tomentulose, not stinging, clavate in bud, swollen around the disc, salverform, 11.4–14 mm; perianth tube 8–11 mm, lobes 6–8 × 3–5 mm in fresh material, elliptic to oblong, reflexed; stamens 10, glabrous, filaments of the upper whorl 11–13.5 mm, those of the lower verticil ca. 8–9 mm, anthers dorsifixed, 2.5–3.3 mm, those of the upper whorl completely exserted, those of the lower whorl partially exserted, the pubescent zone of the staminal column 3–4 mm long with yellowish white indumentum ca. 1 mm, stipitate glandular disc (0.5–)1.1–1.2 mm, orange when fresh, stipe ca. 0.3 mm, staminal column 8–9.5 mm, apex with a pistillode represented by 3 sterile processes somewhat longer than 2 mm; perianth of the pistillate flowers white, adaxial surface glabrous, abaxial surface tomentulose,

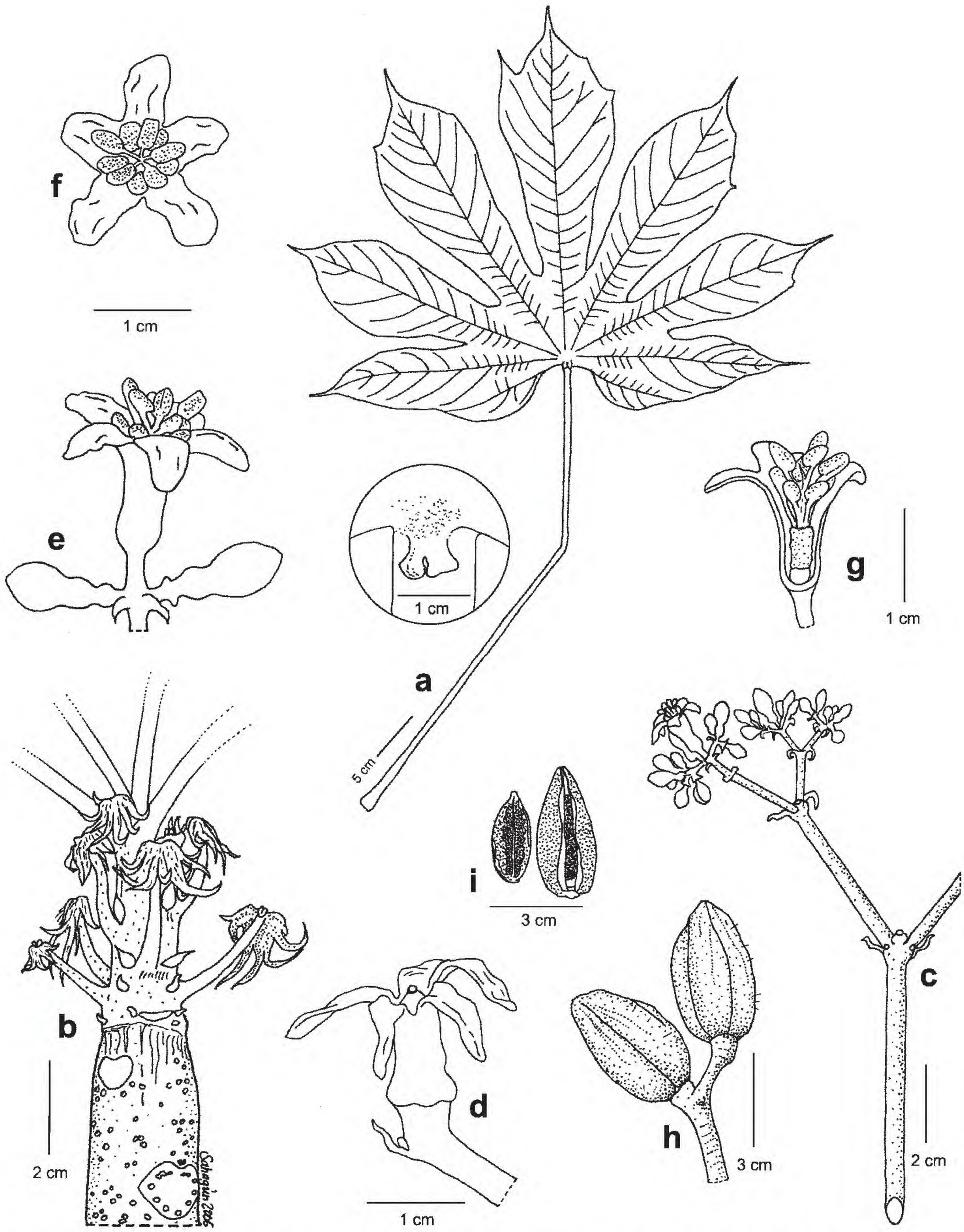

Figure 1. *Cnidoscolus monicanus* J. A. Lomelí, Sahagún & V. W. Steinmann. —A. Leaf showing adaxial surface; inset shows a detail of the petiolar glands. —B. Apex of a sprouting stem showing lenticels, foliar scars, stipules, young leaves, and four peduncles of staminate cymes. —C. Staminate cyme with bracts, flower buds, and one staminate flower at anthesis. —D. Senescent pistillate flower in lateral view showing one bract and the robust pedicel; note the ovary apex with deciduous stigma. —E. Apical section of the staminate inflorescence showing bracts, two flower buds, and one staminate flower in lateral view; note the scale bar above applies to both staminate flowers. —F. Staminate flower viewed from above. —G. Staminate flower in longitudinal section showing in ascending order the pedicel, sectioned single-whorled perianth, glandular disc, pubescent zone of staminal column, and stamens. —H. Nearly mature infructescence in lateral view (note the short peduncle). —I. Seed in dorsal view (left); dry mature dehiscent capsule showing a seed inside (right). A–C, E–G, from a plant cultivated at the Botanic Garden of Universidad Autónoma de Guadalajara (JVET 2234); D, from the holotype, *Sahagún 2396 with Lomelí & Parra* (GUADA); H, I, from *Sahagún 2544* (GUADA).

not stinging, salverform, 17–18 mm, perianth tube 6–9 mm, subcylindrical, gradually narrower toward the throat, proximal diameter 5.5–6 mm, distal diameter 3.5–4 mm, lobes 6–10 × 2–3 mm; ovary pyriform to ellipsoid, 5–7.5 × 2.5–3.5 mm, sulcate or costate, tomentose to sericeous, styles 3, glabrous, 4 mm long, bifid for 1–1.5 mm, disc height 0.5–1 mm, tomentose or hirtellous, green when fresh, brown in pressed material; infructescence with a peduncle 1.7–5 cm × 2–4.5 mm thick, tomentose to tomentulose, the tomentum brown, pedicels glabrescent, 5–20 × 3–5 mm thick; capsule loculicidal, ovoid, 3–4.5 × 1.4–2 cm, the apex rostrate when young and acute at maturity, rostrum 1–3 mm, soon caducous; pericarp green when fresh or dark brown to nearly black in herbarium specimens, hispid, with stinging trichomes ca. 2 mm and 3 ribs to 3 cm on the distal part of each carpel, the lateral ribs longer than the central one, dehiscence lines light colored; columella 3–3.5 cm; seeds elliptic in outline, 2.4–3.2 cm long, 1–1.2 cm wide, 6–7 mm thick, base rounded, apex acute, rostrate, the rostrum 1.5–2 mm; the ventral side straight to shallowly concave, uniformly dark brown or light brown grained with dark brown, with a light brown stripe on the margin and a central longitudinal furrow, the dorsal side light brown grained with dark brown, with a longitudinal central costa.

Habitat and distribution. In Michoacán, the new species occurs in tropical deciduous forest (sensu Rzedowski, 1983) near the ecotone with oak-pine forest, at an elevation of 1430–1640 m with *Agave gypsophila* Gentry, *Bursera* Jacquin ex L., *Clusia salvinii* Donnell Smith, *Ficus* L., *Lysiloma acapulcense* (Kunth) Bentham, and *Neobuxbaumia* Backeberg. In Jalisco, it thrives in tropical semideciduous forest at an elevation of 750–900 m with *Hura polyandra* Baillon, *Ceiba* Miller, *Ficus*, *Brosimum alicastrum* Swartz, and *Euphorbia tanquahuete* Sessé & Mociño.

Apparently endemic to the Sierra Madre del Sur in western Mexico, it is currently known from southwestern Michoacán, in the municipalities of Chinicuila and Coalcomán. It also occurs in Casimiro Castillo, in the Sierra de Manantlán, southern Jalisco.

Conservation status. Conservation status of the new species was assessed using the Method for Evaluation of Extinction Risk for Wild Species in Mexico (MER) (SEMARNAT, 2002). The criteria were assessed as follows:

Criterion A: extent of the distribution of the taxon in Mexico. The territorial extension of Mexico totals about 1,964,375 km^2 (SEP, 1996; INEGI, 2005), while *Cnidoscolus monicanus* is only known from three locations in the municipalities of Chinicuila and Coalcomán, in Michoacán, and from one location in the municipality of Casimiro Castillo, in Jalisco, which together add up to 4873.13 km^2 (INEGI, 1986), or 0.25% of the territory of Mexico. This is considerably less than the 5% of the Mexican territory set as a limit by this criterion; thus, the distribution of *C. monicanus* is considered as "very restricted," which corresponds to a score of 4.

Criterion B: status of the habitat regarding the natural development of the taxon. *Cnidoscolus monicanus* grows in tropical deciduous or semideciduous forest on soils that range from shallow-rocky to relatively deep, usually with abundant calcareous rocks, conditions that are common in southwestern Michoacán, Colima, and southern Jalisco, which led us to consider the habitat as favorable or less limiting and to assign this criterion a score of 1.

Criterion C: intrinsic biological vulnerability of the taxon. This species is noteworthy for its tendency to produce unisexual trees, a trait that requires the simultaneous presence of flowers of both sexes in the vicinity for pollination to take place. Also, we observed few juveniles of about one or two years old but did not observe recently germinated seedlings; this suggests that the rate of recruitment in this species is low, which is confirmed by the small number of populations with few individuals known. We also observed that only fully grown trees produced pistillate flowers and seeds, while younger treelets produced only staminate flowers. Thus, we observed few mature trees in fruit. This has obvious reproductive implications, making this species vulnerable. Furthermore, *Cnidoscolus monicanus* produces the largest seeds in section *Calyptrosolen*, which apparently limits their dispersal unless a vector is involved. We also observed partly eaten seeds among rocks near parent trees, which suggests predation by mammals, as birds normally would eat the seeds whole; this may also have some potential for dispersal. In addition, unlike other species of *Cnidoscolus*, the capsules of *C. monicanus* apparently lack explosive dehiscence, and consequently the seeds fall near the parent plant. We consider that these factors limit the dispersal and reproductive potential of this species and make it vulnerable. The fact that some recruitment is occurring despite the arguments discussed above leads us to consider the vulnerability of this species as intermediate and to assign this criterion a score of 2.

Criterion D: impact of human activities on the taxon. In the locations where this species is known to occur, the native vegetation is cut to grow corn or to induce grasslands as pasture for cattle, which leads to habitat loss and poses a risk to this and other species in those areas. However, a few trees were observed growing on very rocky ground that was unsuitable for

human use. Furthermore, the Jalisco population occurs within the Manantlán Biosphere Reserve, which affords it protection. We concluded that impact of human activities is intermediate and assigned this criterion a score of 3.

To evaluate the status of a species, the scores of the various criteria are summed. Species with total scores between 12 and 14 are considered in danger of extinction, those with a score of 10 or 11 are threatened, and those with scores of 9 or below are considered to be at little current risk. The sum of the scores of all criteria totaled 10, thus *Cnidoscolus monicanus* is considered threatened.

We also evaluated the conservation status of *Cnidoscolus monicanus* using the applicable criteria of the International Union for the Conservation of Nature and Natural Resources (IUCN, 2001). The distribution as presently known is severely fragmented. Only four confirmed localities are known to exist. In all of them, except in the Manantlán Biosphere Reserve, habitat loss is creating pressure on existing populations. With the information currently at hand, we estimated the total population size to be fewer than 2500 mature individuals. Due to the limited use of the new species by rural people, a continuing decline in the populations due to land-use change is observed. However, this is not the case in the Manantlán Biosphere Reserve, which is estimated to contain the majority of mature individuals. The Michoacán populations have only a handful of mature trees. The new species may very likely also occur in Nayarit, but we do not have any confirmed collections or population size estimates from that state. Based on the analysis of IUCN Red List criteria given here, we conclude that *C. monicanus* is Endangered (EN).

Phenology. Foliage is present from mid-June to October, with flowering from April to June, and fruiting from September to October.

Etymology. The specific epithet honors Mónica Edith Lomelí-Zavala, a young student of biology and daughter of the senior author.

Common name. Chicle (Nicanor Mendoza, 2001, pers. comm.).

Potential use and economic value. Although no actual uses were observed in the sites where *Cnidoscolus monicanus* was recorded, the species produces abundant white latex, which has potential as a source of natural rubber. The latex of the closely related *C. tepiquensis* is used in Talpa de Allende, in western Jalisco, and in Huajicori, Acaponeta, in northern Nayarit, to produce colorful art crafts. The seeds are reportedly edible either raw or roasted, and are known as "cucarachos" as they resemble cockroaches.

Discussion. Cnidoscolus monicanus is closely related to *C. elasticus* and *C. tepiquensis*, with which it shares an arborescent, nearly unarmed habit at maturity, solid pith, similar pistillate perianth length, and large fruits and seeds. Based on these characteristics, we hypothesize that the three species comprise a monophyletic group in section *Calyptrosolen*. All three species of this complex produce abundant latex, which according to Williams (1962, for *C. elasticus* and *C. tepiquensis*) contains a high percentage of hydrocarbons and resin. In addition, the plants in this group have a tendency to produce unisexual cymes. They are restricted to the Pacific slope of western Mexico, and the species are allopatrically distributed north to south as follows: *C. elasticus*, *C. tepiquensis*, and *C. monicanus*. Although the southern distribution limit of *C. elasticus* seems to overlap slightly with the northern distribution limit of *C. tepiquensis* in southern Sinaloa, the taxa are separated by elevation, with the former restricted to the highlands in the mountains and the latter found at low elevations. Similarly, altitudinal differences farther south also separate *C. tepiquensis* and *C. monicanus*, with the latter occurring at higher elevations than the former. Although the elevation ranges shown in Table 1 overlap slightly, there is no evidence that any of the species grow sympatrically. Because of the absence of herbarium specimens and his inability to find *C. tepiquensis* in the municipality of Concordia, in Sinaloa, Breckon (1975) questioned Lundell's (1945) assertion that this municipality is the northern limit of this species. However, we collected *C. tepiquensis* near Cacalotán (23°04′28″N, 105°51′17″W), growing at an elevation of 50 m in the municipality of Rosario, which is adjacent to Concordia (*J. A. Lomelí-Sención 3658 with E. Ramírez M. & G. E. Lomelí Z.*, GUADA). This finding supports Lundell's distributional limit indicated above.

This new taxon is closely related to *Cnidoscolus elasticus*, with which it shares two discrete petiolar glands, few, obscure marginal teeth in the leaf lamina that are only rarely caudate, staminate flowers with a long pubescent zone (usually 3–4 mm) on the staminal column, pistillate flowers with an abaxially pubescent perianth, a pubescent ovary, short peduncles of the infructescence, capsules that are acute at maturity, and a habitat at higher elevations. However, *C. monicanus* differs from *C. elasticus* in its grayish non-exfoliating bark, verticillate branching, glabrous stipules, longer capsule pedicels, and larger leaf lamina, fruits, and seeds (Table 1).

Cnidoscolus monicanus is also related to *C. tepiquensis*, with which it shares verticillate branching, grayish to light brown non-exfoliating bark, large leaf laminas with seven or nine primary palmate veins,

similar staminate flower bud shape, longer capsule pedicels, and longer columellas and seeds. However, *C. monicanus* is distinguished from *C. tepiquensis* by its glabrous stipules, petioles with two discrete glands, leaf margins that are entire or with few obscure to rarely caudate teeth, staminate flowers with a longer pubescent zone on the staminal column, pistillate flowers with a tomentulose perianth, longer tomentose to sericeous ovaries, shorter peduncles of the pistillate infructescences, capsules with distal ribs and acute apex, and a habitat at a higher elevation (Table 1). These two species' contrasting adaptations to climate, brought about by the varying elevation, is very evident in the plants cultivated at "Jorge Victor Eller T." Botanical Garden, which is located at an elevation of 1700 m and has a mean annual temperature of 23.3°C. These conditions are similar to those found in the habitat of *C. monicanus* but have been stressfully cold for *C. tepiquensis*, which has grown slowly in 15 years of cultivation. Contrastingly, *C. monicanus* has grown vigorously, reached the same height as *C. tepiquensis*, and attained a thicker trunk in nine years of cultivation.

Breckon's (1975) concept of *Cnidoscolus tepiquensis* includes what we describe here as *C. monicanus*. This conclusion is based on his description of the species and on his identification of a specimen (*McVaugh 19850*, MICH) as *C. tepiquensis*, a duplicate of which (IEB) we identify as *C. monicanus*. Furthermore, in the illustration he presents for *C. tepiquensis* (Breckon, 1975: pl. 30a), the leaf is more typical of *C. monicanus*. Unfortunately, we were unable to see the specimen on which the drawing is based (*Breckon & Breckon 1378* [DAV]) and cannot confirm our determination based on the illustration. A typical leaf of *C. tepiquensis* may be seen in Williams (1962: fig. 11).

It is presently unclear which species of the complex is more closely related to *Cnidoscolus monicanus*. Although our key shows *C. monicanus* and *C. elasticus* together in couplet 2, that does not indicate a closer affinity. The key is artificial and was built using the most distinctive characters available. A cladistic study is needed to clarify the affinities within the complex.

Key to the Species of the *Cnidoscolus tepiquensis* Complex in Mexico

1a. Leaves rarely with 0 to 3(6) caudate teeth similar to the caudate lobe apices; petiolar glands 2, discrete, projecting outward from the epidermis, cushion-like; ovary tomentose to sericeous; fruiting peduncle ≤ 13 cm long; staminate flowers with the pubescent zone of the staminal column ≥ 3 mm long; capsule with apex acute at maturity.

2a. Trunk bark non-exfoliating, gray or reddish brown; branching verticillate; mature leaves glabrescent, 16–60 × 25–75 cm, stipules glabrous; pedicel of staminate flower > 1.5 mm long after abscission, capsule pedicel 5–20 mm long; pericarp ribbed; columella 30–35 mm long; seeds 24–32 mm long . . . . . *C. monicanus*

2b. Trunk bark exfoliating, reddish brown; branching not verticillate; mature leaves tomentose, smaller, to 15 × 25 cm, stipules tomentose; pedicel of staminate flower < 0.5 mm long after abscission; capsule pedicel 0–1.3 mm long; pericarp not ribbed; columella ca. 23 mm long; seeds 17–23 mm long . . . . . *C. elasticus*

1b. Leaves with 20 to 28 caudate teeth similar to the caudate lobe apices; petiolar gland 1, U-shaped, flush with the epidermis, not cushion-like; ovary glabrous; fruiting peduncle ≥ 20 cm long; staminate flowers with the pubescent zone of the staminal column < 2.5 mm long; capsule with apex rounded at maturity . . . . . *C. tepiquensis*

Paratypes. MEXICO. **Jalisco:** Mun. Casimiro Castillo, tropical forest in barranca 16 mi. SW of Autlán (seaward slopes 6.5 mi. below hwy. pass), 750 m, 4 Oct. 1960 (fr.), *R. McVaugh 19850 with C. Feddema & R. W. Pippen* (IEB). **Michoacán:** Mun. Chinicuila, near Tehuantepec on hwy. Aquila–Coalcomán, 9 June 2001 (fl.), *E. Sahagún 2306 & J. A. Lomelí* (GUADA), 4 Oct. 2002 (fr.), *E. Sahagún 2544 with J. A. Lomelí & P. Carrillo* (GUADA); 22 Apr. 2005 (fl.), material obtained from previous locality cultivated at the JVET Botanic Garden, Universidad Autón. Guadalajara, *J. A. Lomelí 3796 with E. Sahagún & S. Parra* (GUADA); Mun. Coalcomán, La Yerbabuena del Naranjillo, cañada del Colorín, 28 Apr. 1990 (fl.), *H. Díaz-Barriga & E. Pérez-Cálix s.n.* (IEB).

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Two New Species of *Sonerila* (Melastomataceae) from South India

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Abstract. The two new species *Sonerila anaimudica* Lundin & B. Nordenstam and *S. coriacea* Lundin & B. Nordenstam, from Kerala and Tamil Nadu, respectively, are recognized in connection with a taxonomic revision of the South Indian species of *Sonerila* Roxburgh (Melastomataceae). Descriptions, discussions, and illustrations are provided. Both species are endemic to the Western Ghats in South India. *Sonerila anaimudica* is a small succulent herb, and the usually single terminal flower has very obtuse or even retuse obovate petals with glandular margins. *Sonerila coriacea* is a somewhat woody succulent herb with a coriaceous layer on the stems, coriaceous leaves, and showy racemose flowers. Both species have restricted distribution and small populations and are regarded as Vulnerable (VU) and Endangered (EN), respectively, based on IUCN Red List criteria.

Key words: IUCN Red List, Melastomataceae, *Sonerila*, South India, Western Ghats.

Sonerila Roxburgh is an Asiatic genus of the Melastomataceae with ca. 175 species of herbs and shrublets all characterized by the trimerous flowers. The genus is well represented in South India, where five species groups were distinguished by Lundin (1998). Two new species of *Sonerila* from South India are described, *S. anaimudica* Lundin & B. Nordenstam, which belongs to the *S. speciosa* Zenker group, and *S. coriacea* Lundin & B. Nordenstam, which belongs to the *S. grandiflora* R. Brown group. The two new species are locally endemic with very limited distribution areas.

After conducting a field trip in southern India in 1982, the first author recognized six new taxa of *Sonerila* on the basis of collected and herbarium material. Material of the South Indian species of *Sonerila* was studied mainly in the herbaria of BM, CAL, K, MH, and S. Subsequently, four of these six new taxa have been described elsewhere, viz. *S. cannanorensis* G. S. Giri & M. P. Nayar (Giri & Nayar, 1985), *S. kanniyakumariana* Gopalan & A. N. Henry (Gopalan & Henry, 1988), *S. talbotii* G. S. Giri & M. P. Nayar (Giri & Nayar, 1986), and *S. parameswaranii* K. Ravikumar & V. Lakshmanan (Ravikumar, 1999). This last-mentioned species was provisionally recognized in Lundin (1998) as *S. pedicellaris* Lundin ined. (without Latin diagnosis), but because the species was validly published by Ravikumar and Lakshmanan (Ravikumar, 1999), their name, *S. parameswaranii*, must be used.

1. Sonerila anaimudica Lundin & B. Nordenstam, sp. nov. TYPE: India. Kerala: Kottayam Distr., Anai Mudi, adjoining hill, 2300 m, 20 Oct. 1982, *J. Klackenberg & R. Lundin 429* (holotype, S; isotype, K). Figure 1.

Herba erecta parva; caules basi bulbosi, carnosissimi, simplices, brunneo-virentes, pilis glanduliferis albis vestiti. Folia petiolata; petiolus pilis glanduliferis albis dispersis; lamina ovata cordata carnosa serrulata 5- ad 7-nervis, supra atro-virens pilis glanduliferis albis dispersis, subter rubella glabra vel pilis paucis vestita. Flores solitarii vel in inflorescentiam 2- vel 3-floram pedunculatam dispositi; pedunculus et pedicelli glanduliferi. Petala rosea obovata apicibus retusis. Capsula campanulata pilis dispersis vestita, sepalis tribus viridibus coronata.

Small herb, 1–3.5 cm high, with basally bulb-like stems, succulent; stems unbranched, 3–6 mm thick, terete, brownish green, with whitish glandular hairs. Leaves petiolate; lamina ovate to broadly ovate, fleshy, cordate to deeply cordate with overlapping margins at the base, obtuse with the central nerve extending into the mucronate apex, 0.5–3 × 0.5–2 cm, dark green with scattered white hairs adaxially, reddish green and glabrous abaxially, or with few hairs (especially at the veins), finely serrate, 5- to 7-nerved; petioles 0.5–2.5 cm, greenish and with scattered, whitish glandular hairs. Flowers solitary or in 2- or 3-flowered peduncled subdichotomous scorpioid raceme; peduncles 1–2.5 cm, with whitish glandular hairs, brownish green; pedicels ca. 0.5 cm, bright green, with glandular hairs, with a minute, membranaceous, subulate bract at the base. Petals pink, obovate, with glandular hairs on margins and abaxial veins, ca. 0.7 × 0.7 cm, with rounded or retuse apex; anthers yellow, 0.2–0.3 cm, ovate, cordate at the base, acute at the apex; filaments simple, striate, reddish. Capsule campanulate, with scattered hairs, ca. 0.7 cm, crowned with 3 green persistent sepals.

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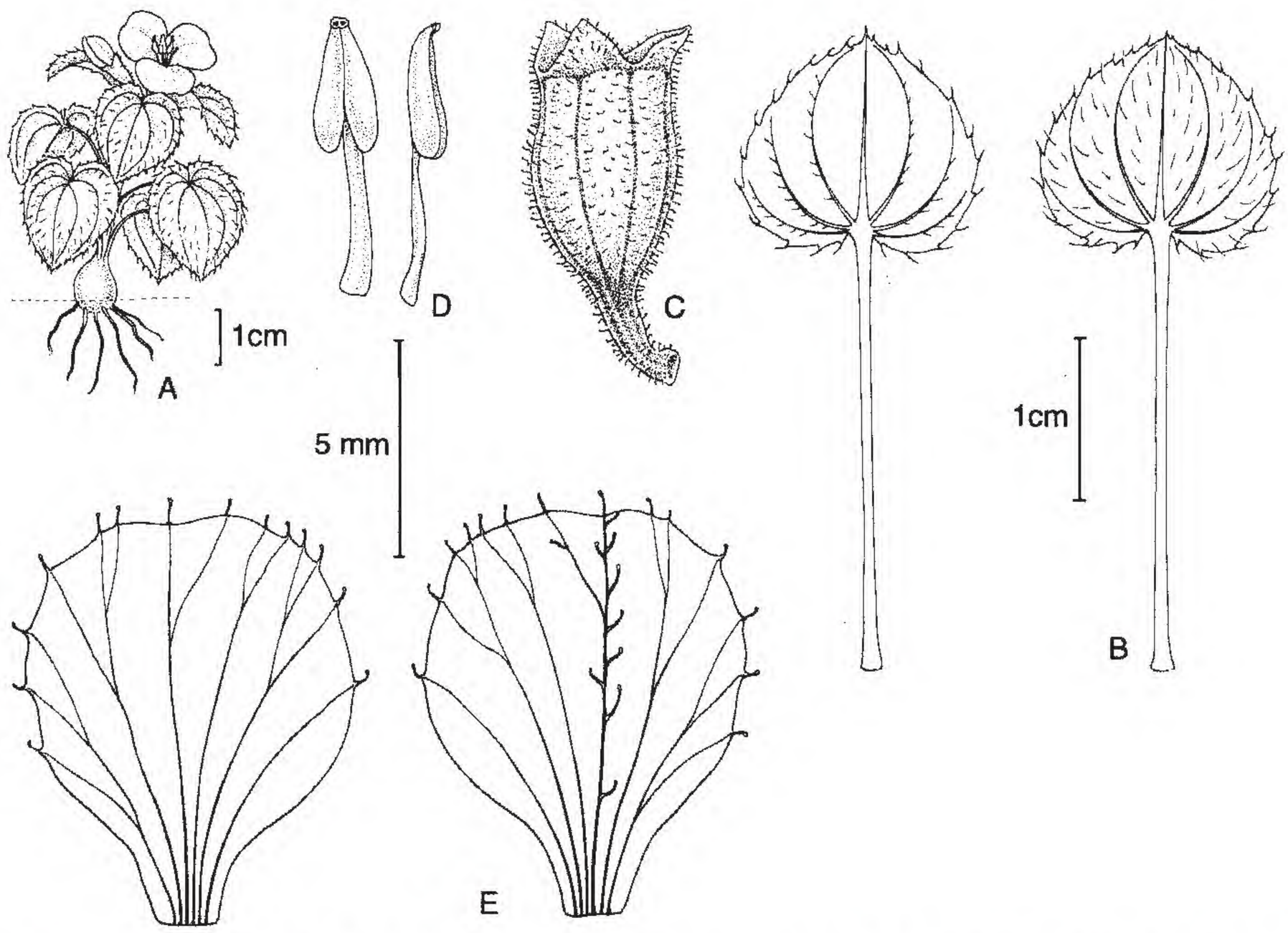

Figure 1. *Sonerila anaimudica* Lundin & B. Nordenstam. —A. Habit. —B. Leaf, abaxial view (left) and adaxial view (right). —C. Capsule. —D. Anther. —E. Petal, adaxial view (left) and abaxial view (right). A, C, E drawn from the type, *Klackenberg & Lundin 429* (S); B, D drawn from *Chandrabose 69018* (K). The 5 mm scale bar applies to C, D, and E.

Discussion. *Sonerila anaimudica* (Fig. 1) is a small, unbranched, very succulent herb with a basally bulbous stem. The stems are sometimes sparsely branched when cultivated in the greenhouse, and extend to 1–5 cm long, opposite branches (cultivated from the type *J. Klackenberg & R. Lundin 429*). The species does not otherwise change its habit during cultivation. The peduncles often have only one terminal flower. The petals are characteristically glandular-pubescent on margins and abaxial veins and are very obtuse or retuse, not pointed as in other species of *Sonerila* in South India. This species is locally endemic and occurs only in the Anaimalais, growing in shaded rock crevices at the adjoining hills to Anai Mudi in the mountain region above 2000 m. Based on the paucity of known localities (two) and the small population size as observed in the field (less than 12 individuals in the type locality), the species may be classified as Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001).

This new species belongs to the *Sonerila speciosa* group (Lundin, 1998), which now consists of three species, viz. *S. speciosa* Zenker, *S. gamblei* G. S. Giri & M. P. Nayar, and *S. anaimudica*, all confined to the Nilgiris and the Anaimalais of the Western Ghats of South India. The species of this group are characterized by stems with short internodes and leaves almost whorled, like an elongated rosette, terminated by a distinct peduncle with a few-flowered subdichotomous inflorescence or a solitary flower.

Paratype. INDIA. **Tamil Nadu:** Coimbatore Distr., Konalar, Anamalai Hills, 2150 m, 1980, *Chandrabose 69018* (K, MH).

2. Sonerila coriacea Lundin & B. Nordenstam, sp. nov. TYPE: India. Tamil Nadu: Kanyakumari Distr., Mahendragiri Peak, 4500 ft., *R. H. Beddome 3051* (holotype, K). Figure 2.

Herba erecta robusta et sublignosa glabra parce ramosa; caules et rami crassi subteretes, corio crasso rubello obtecti, cicatricibus foliorum delapsorum prominentibus notati. Folia petiolata; lamina ovata usque lanceolata coriacea 5-nervis, basi obtusa usque acuta, apice acuta, marginibus sursum serrata. Inflorescentia pedunculata racemosa 3- ad 6-flora. Petala rubra ovata acuta. Capsula obconica in pedicellum gradatim angustata, sepalis in fructu caducis.

Erect herb, 30–50 cm high, robust and semi-woody, glabrous, younger shoots succulent; stems and branches thick, ± terete, covered with a thick reddish corium, with prominent leaf scars, sparsely branched. Leaves ovate to lanceolate, extremely coriaceous, green adaxially, reddish green abaxially, 5-nerved, fleshy, obtuse to acute and symmetrical at the base, serrate in the upper 2/3, acute at the apex; lamina 2–5

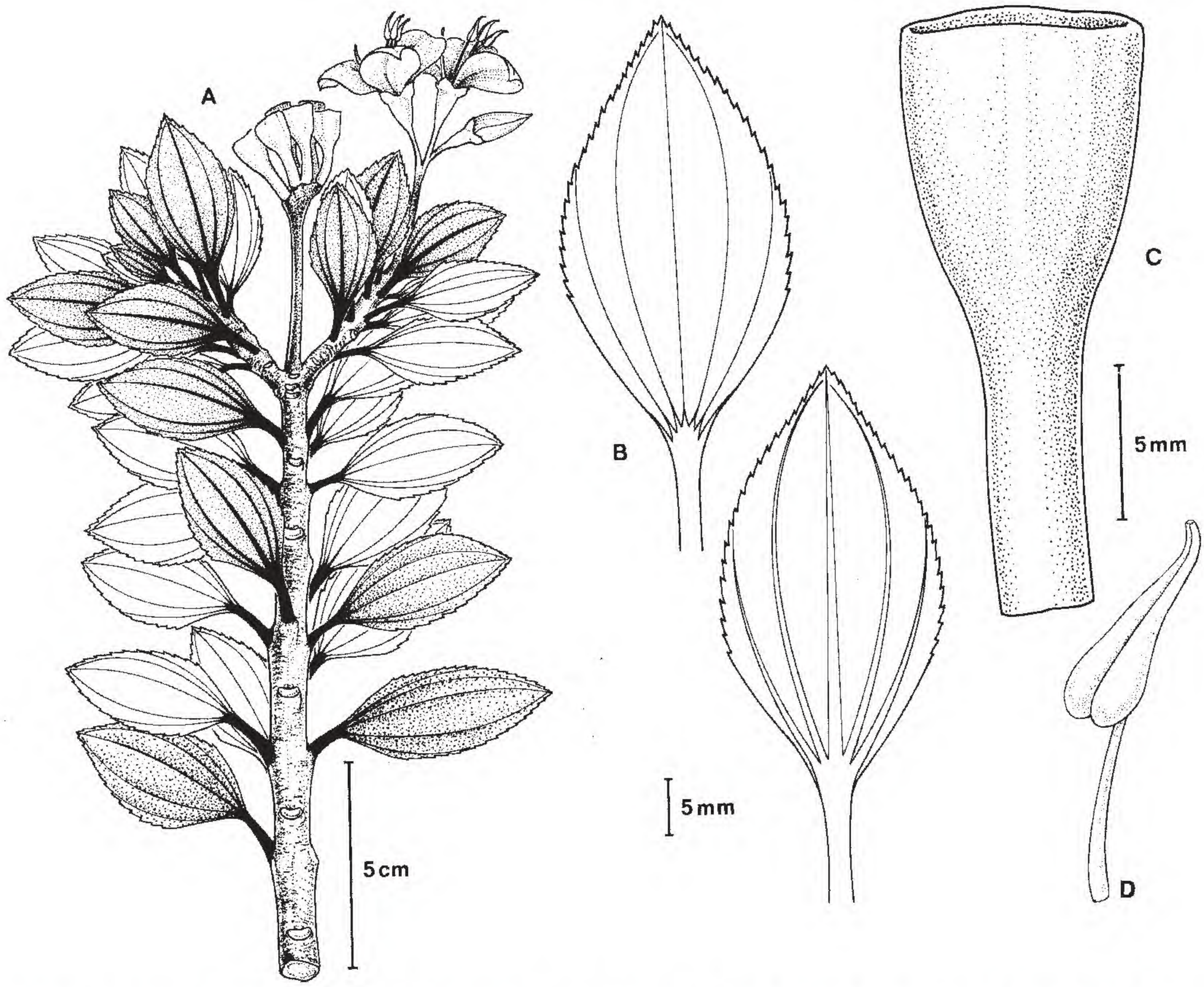

Figure 2. *Sonerila coriacea* Lundin & B. Nordenstam. —A. Habit. —B. Leaf, adaxial view (left) and abaxial view (right). —C. Capsule. —D. Anther. A (p.p.), B, C drawn from the type, *Beddome 3051* (K); A (p.p.), D drawn from *Shetty 33060* (MH). Scale bar at far right applies to C and D.

× 1–2.5 cm; petiole 1/4 the length of the lamina. Flowers showy in 3- to 6-flowered scorpioid racemes; peduncles 2–4.5 cm; petals red, ca. 1.5 cm, ovate, pointed; anthers narrowly ovate, rostrate, ca. 0.7 cm, connective simple. Capsule obconical, glabrous, lusterless (dull), ca. 0.8 cm, tapering into ca. 0.7 cm pedicel; sepals caducous in fruit.

Discussion. Despite its semi-woody coriaceous habit, *Sonerila coriacea* (Fig. 2) belongs to the largely herbaceous succulent *S. grandiflora* group, now consisting of seven montane species from the Nilgiris in the north to the Tinnevelleys in the south of India (Lundin, 1998). The species of this group are glabrous and large-flowered with red or purple petals 1.5–2 cm long. The new species much resembles *S. devicolamensis* M. P. Nayar in habit, but is more robust and semi-woody. The plant has developed a characteristic coriaceous layer on the stems and leaves that could be mistaken for a very dense and short tomentum. *Sonerila coriacea* has a very restricted distribution in the area around Mahendragiri Peak in the Tinnevelley Hills and is locally endemic and rare. Also, no recent collections have been recorded since it was last collected in 1969. Therefore, its conservation status may be classified as Endangered (EN) according to IUCN Red List criteria (IUCN, 2001).

Paratype. INDIA. **Tamil Nadu:** Kanyakumari Distr., Mahendragiri Peak, 1480 m, 6 Dec. 1969, *B. V. Shetty 33060* (MH).

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New Species of *Eugenia* sect. *Racemosae* (Myrtaceae) from the Atlantic Forest, Eastern Brazil

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Abstract. Morphological characters support the description of four new species of *Eugenia* L. sect. *Racemosae* O. Berg (Myrtaceae) from Brazilian Atlantic Forest. The new species are described, illustrated, and compared with putatively related species. They are: *E. brunneopubescens* Mazine from Paraná, *E. capixaba* Mazine from Espírito Santo, *E. costatifructa* Mazine from Bahia and Sergipe, and *E. longibracteata* Mazine from São Paulo.

Resumo. Quatro espécies novas de *Eugenia* L. sect. *Racemosae* O. Berg (Myrtaceae) da Mata Atlântica são descritas, ilustradas e comparadas com as espécies relacionadas. São elas: *E. brunneopubescens* Mazine do Paraná, *E. capixaba* Mazine do Espírito Santo, *E. costatifructa* Mazine da Bahia e Sergipe e *E. longibracteata* Mazine de São Paulo.

Key words: Atlantic Forest, Brazil, *Eugenia*, IUCN Red List, Myrtaceae.

Eugenia L. is the largest genus in Myrtaceae, with ca. 500 (Holst et al., 2003) to 2000 species (Sanchez-Vindas et al., 2001) distributed from southern Mexico, Cuba, and the Antilles, to Uruguay and Argentina, with a smaller number of species (ca. 60) in Africa (Merwe et al., 2005). Some species with edible fruits have been cultivated in tropical and subtropical regions (e.g., *E. uniflora* L., *E. brasiliensis* Lamarck). *Eugenia* is the genus with the highest number of species of trees in the ombrophilous dense forest surrounding Brazil's Atlantic border, locally called the Mata Atlântica (Oliveira-Filho & Fontes, 2000).

Eugenia sect. *Racemosae* O. Berg can be distinguished by flowers arranged exclusively in racemes and/or panicles, with a distinct axis bearing the flowers in which the pedicel:internode ratio is 2:1 or less. During the preparation of a monograph of *Eugenia* sect. *Racemosae* O. Berg for the Flora Neotropica project, several new species were found, and descriptions of four new species from the Atlantic Forest of Brazil are presented here. Distribution data, illustrations, and comments for the described species are also provided.

1. Eugenia brunneopubescens Mazine, sp. nov. TYPE: Brazil. Paraná: Quatro Barras, Morro Sete, 14 Jan. 1993, *J. M. Silva & M. Sobral 1206* (holotype, ESA; isotypes, C, MBM, SPF, W). Figure 1A–C.

Haec species *Eugeniae oblongatae* O. Berg affinis, sed: ab ea foliis 6–9.2 cm (nec 10.5–24.5 cm) longa sine laesionibus circularibus atque racemo tenui distincta.

Tree 5–12 m; young branches moderately pubescent, glabrescent. *Leaf blade* elliptic, 6–9.2 × 2–3.2 cm, coriaceous, without rounded injuries, glabrescent to densely pubescent on abaxial surface, with brown trichomes, glabrescent to moderately pubescent on adaxial surface, with simple and dibrachiate trichomes, apex acuminate, base attenuate, midvein sulcate, moderate to densely pubescent on both surfaces, the lateral veins indistinct or plane on adaxial surface, marginal vein doubled, the inner one 2.5–4 mm from the margin; glandular dots impressed on adaxial surface; petiole 1.2–1.4 cm. *Raceme* axillary, slender with 2 to 5 pairs of flowers, peduncle 5–8 mm, rachis 0.4–1.5 cm, densely pubescent, with brownish trichomes; floral bracts persistent, 1.5–2 mm; pedicel 4–5 mm, densely pubescent, bracteoles ca. 1 mm, basally connate, apex acute, persistent, subglabrous, midvein pubescent, with ciliate margin. *Flower bud* ca. 2 mm diam., sepals 1–1.5 mm, apex rounded, subglabrous to moderately pubescent, with ciliate margin, persistent; petals 4–5 mm, oblong or orbicular, apex obtuse; stamen filaments 4–5 mm, glabrous; hypanthium densely pubescent, style ca. 5 mm, glabrous. *Fruit* globular, 6–9 × 5–8 mm, red, moderately pubescent, surface glandular, not costate.

Distribution and habitat. *Eugenia brunneopubescens* is endemic to Quatro Barras, Paraná State, Brazil, from the Floresta Pluvial de Encosta de Morro and Floresta Montana.

IUCN Red List category. *Eugenia brunneopubescens* is considered Vulnerable (VU D1) according to IUCN Red List criteria (IUCN, 2001).

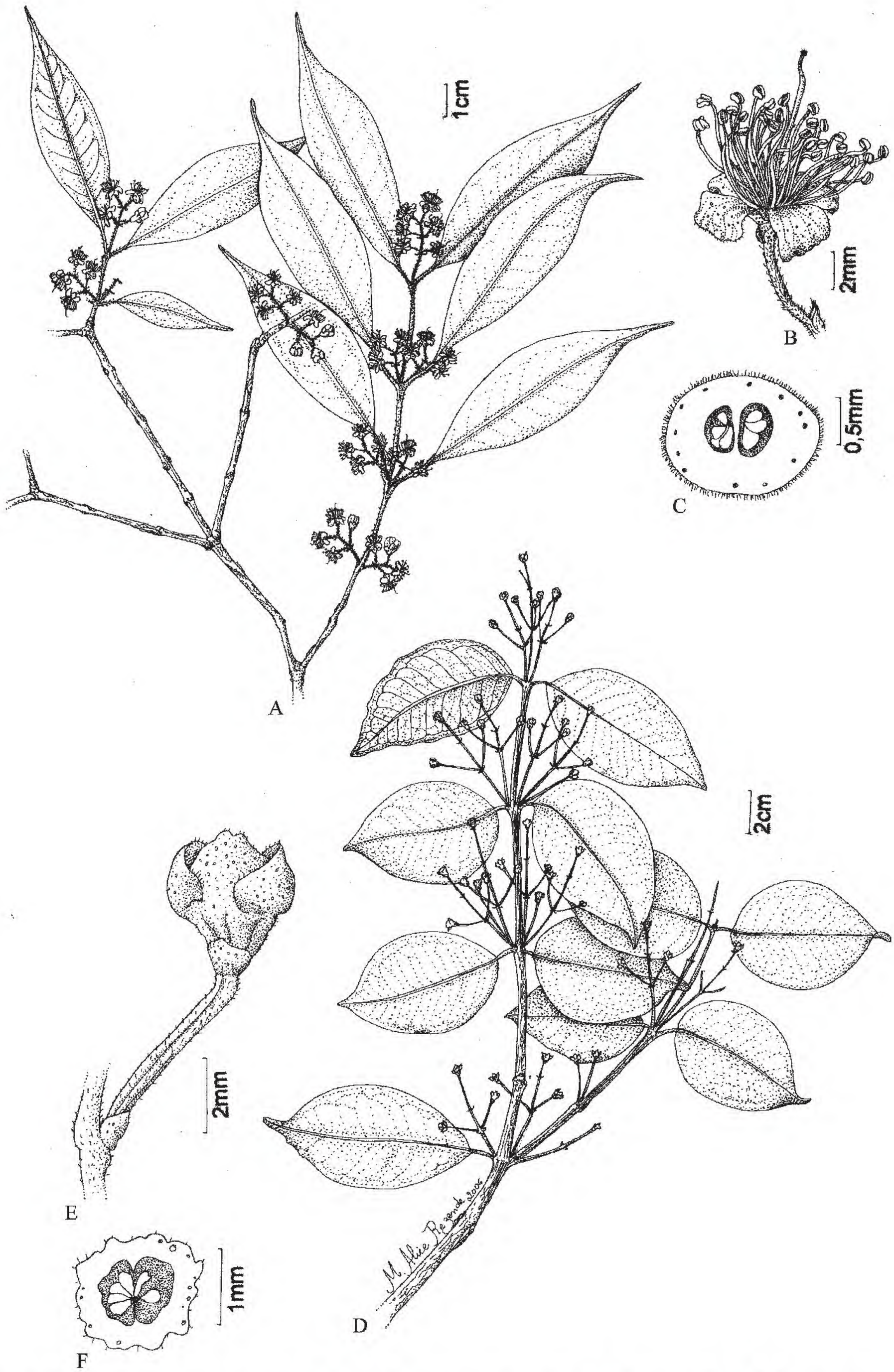

Figure 1. A–C. *Eugenia brunneopubescens* Mazine. —A. Flowering branch. —B. Flower. —C. Medial section of ovary. D–F. *Eugenia costatifructa* Mazine. —D. Flowering branch. —E. Flower bud. —F. Medial section of ovary. A–C drawn from the holotype *Silva & Sobral 1206* (ESA); D–F drawn from the holotype *Pinto et al. 167/82* (CEPEC).

Discussion. *Eugenia brunneopubescens* has been collected only in Quatro Barras, in Paraná State, Brazil. The new species is distinguished by its pubescent hypanthium, persistent floral bracts and bracteoles, and brownish trichomes on the abaxial surface of the leaves and inflorescences. The leaf indument is deciduous. The new species has morphological affinity with *E. oblongata* but can be distinguished from that species by its smaller leaf blades (6–9.2 cm vs. 10.5–24.5 cm long) without rounded injuries and its slender racemes (vs. stouter racemes in *E. oblongata*). Furthermore, *E. brunneopubescens* occurs only in Paraná State, whereas *E. oblongata* has a broader distribution, as it is known from the states of Espírito Santo, Minas Gerais, Rio de Janeiro, and São Paulo in Brazil.

Paratypes. BRAZIL. **Paraná:** Quatro Barras, Morro Sete, 30 Jan. 1990, *O. S. Ribas & V. Nicolack 227* (C, G, MBM, RB, SPF, SPSF); Serra da Baitaca, 1100 m.s.m., 6 Apr. 1990, *Y. S. Kuniyoshi & F. Galvão 5519* (MBM).

2. Eugenia capixaba Mazine, sp. nov. TYPE: Brazil. Espírito Santo: Linhares, Vale da Lagoa, Juparanã, 17 July 1970, *T. S. Santos 959* (holotype, CEPEC; isotype, MBML). Figure 2A–C.

Haec species *Eugeniae pruniformi* Cambessedes affinis, sed ab ea foliis pilis bifurcatis (nec simplicibus) pubescentibus, racemis florum paria 7 ad 13 (nec 2 ad 8) ferentibus rhachidi 2.5–4 cm (nec 0.5–3.5 cm) longa atque alabastris ca. 4 mm (nec 2–2.5 mm) diam. distincta.

Shrub ca. 3 m; young branches densely pubescent, glabrescent. *Leaf blade* elliptic, 9.8–12.3 × 4.7–5.7 cm, chartaceous, sparsely pubescent on both surfaces, trichomes dibrachiate; blade apex shortly acuminate, base acute; midvein sulcate, moderately pubescent on both surfaces; lateral veins slightly sulcate, marginal vein doubled, the inner one ca. 3 mm from the margin; glandular dots indistinct on adaxial surface; petiole 7–9 cm. *Raceme* axillary, subsessile, with 7 to 13 pairs of flowers, peduncle 0–2 mm, rachis 2.5–4 mm, densely pubescent, trichomes ferruginous; floral bracts persistent; pedicel 1–4 mm, densely pubescent, bracteoles ca. 1 mm, free, not basally connate, ovate, apex acute, persistent, densely pubescent. *Flower bud* ca. 4 mm diam.; sepals ca. 2 mm, apex rounded, glabrous to subglabrous, persistent; petals 4–5 mm, elliptic-orbicular, apex obtuse; stamen filaments 4–5 mm, subglabrous; hypanthium very densely pubescent, not costate, style 5–6 mm, subglabrous. *Fruit* not observed.

Distribution and habitat. *Eugenia capixaba* is known by a single flowering collection from 1970, from Linhares, Espírito Santo State, Brazil, from the Atlantic Forest region, and has evidently not been collected again.

IUCN Red List category. *Eugenia capixaba* is considered Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Discussion. *Eugenia capixaba* belongs to the group in *Eugenia* sect. *Racemosae* characterized by racemes with ferruginous trichomes, flowers with persistent bracts and bracteoles, and a pubescent hypanthium. It is very similar to *E. pruniformis*, which is also part of this species group. However, *E. capixaba* can be distinguished from *E. pruniformis* by its longer, multi-flowered racemes (rachis 2.5–4 cm long and 7 to 13 pairs of flowers vs. rachis 0.5–3.5 cm long and [2 to]4 to 8 pairs of flowers). Furthermore, the leaves of the new species have dibrachiate trichomes (vs. simple ones).

3. Eugenia costatifructa Mazine, sp. nov. TYPE: Brazil. Bahia: Entre Rios, Subaúma, 12°13′S, 37°52′W, 8 Dec. 1982, *G. Pinto, J. Arouck, H. Bautista & A. Araújo 167/82* (holotype, CEPEC). Figure 1D–F.

Haec species a congeneris brasiliensibus ad *Eugeniam* sect. *Racemosas* pertinentibus foliis coriaceis nitidis base rotundatis, racemo longo, bracteis floralibus persistentibus, hypanthio fructuque costato distinguitur.

Shrub to tree 3–4 m; young branches sparsely puberulous. *Leaf blade* widely elliptic, 6.5–12 × 5.2–7.2 cm, coriaceous, lustrous, moderately puberulous on both surfaces, apex shortly acuminate, base rounded, midvein sulcate, moderately puberulous on both surfaces, lateral veins slightly prominent, marginal vein 2–4 mm from the margin; glandular dots prominent on adaxial surface; petiole 0.8–1.2 cm. *Raceme* axillary, with 2 pairs of flowers, peduncle 0.5–2.3 cm, rachis 0.2–1 cm, glabrous to sparsely puberulous, with white trichomes; floral bracts persistent, pedicel 0.6–1.4 cm, glabrous to sparsely puberulous, bracteoles ca. 1 mm, basally connate, cordate, persistent. *Flower bud* 3–4 mm diam.; sepals 1.5–2 mm, apex rounded, subglabrous, persistent; petals not observed; stamen filaments 3–4 mm, subglabrous; hypanthium subglabrous to sparsely puberulous, costate; style ca. 5 mm, subglabrous. *Fruit* globular, 2–3.5 × 2.2–3.3 cm, yellow to orange, subglabrous, surface costate, glandular.

Distribution and habitat. *Eugenia costatifructa* grows in restinga vegetation from the Brazilian states of Bahia and Sergipe.

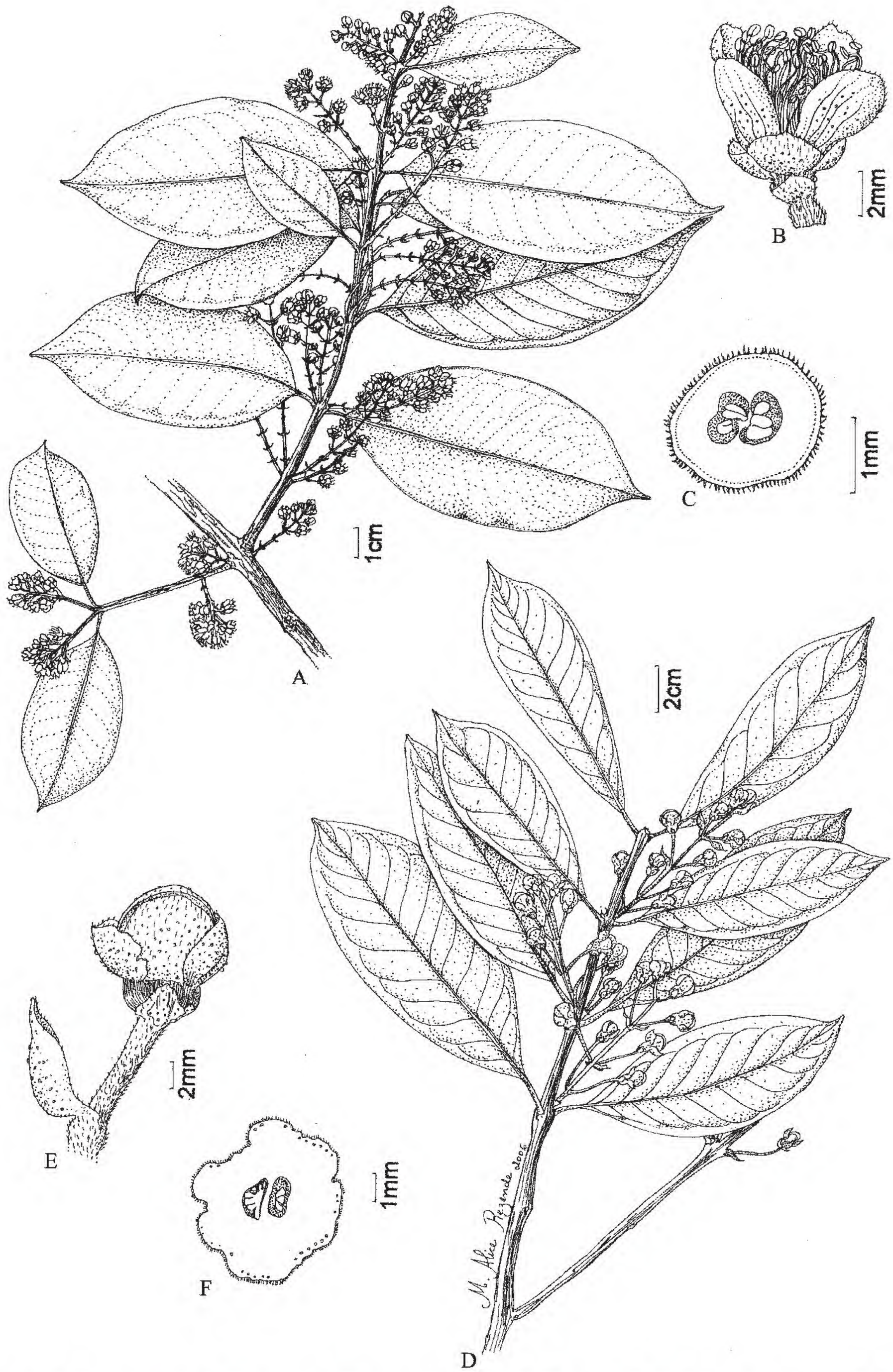

Figure 2. A–C. *Eugenia capixaba* Mazine. —A. Flowering branch. —B. Flower. —C. Medial section of ovary. D–F. *Eugenia longibracteata* Mazine. —D. Flowering branch. —E. Flower bud. —F. Medial section of ovary. A–C drawn from the holotype *Santos 959* (CEPEC); D–F drawn from the paratype *Ferretti et al. 152-A* (ESA).

IUCN Red List category. *Eugenia costatifructa* is considered Vulnerable (VU B1ac[iii]) according to IUCN Red List criteria (IUCN, 2001).

Discussion. This new species has long racemes and flowers with persistent floral bracts. The principal characters of *Eugenia costatifructa* are the flowers with costate hypanthium and fruits also with a costate surface. The leaves are coriaceous and shiny, with a rounded base.

Paratypes. BRAZIL. **Bahia:** Mata de São João, Sauípe, Litoral Norte, 12°31′S, 38°17′W, 13 June 2000, *M. L. Guedes, E. M. Silva & L. B. Silva 7028* (CEPEC); Entre Rios, Subaúma, 8 Dec. 1982, *J. Arouck, H. Bautista, A. Araújo & G. Pinto 222* (CEPEC, ICN); 12°13′44″S, 37°47′56″W, 19 Feb. 1980, *P. A. Adonias 236* (CEPEC). **Sergipe:** Santo Amaro das Brotas, restinga após o rio Pomonga, 19 Jan. 1992, *C. Farney, R. A. Silva & S. B. Santos 2905* (RB).

4. **Eugenia longibracteata** Mazine, sp. nov. TYPE: Brazil. São Paulo: Cunha, Estação Experimental da Serra do Mar, 23°15′25.5″S, 45°02′32″W, 14 Dec. 1996, *A. R. Ferretti, A. Vanini, A. G. Nave, F. M. Peneireiro, R. R. Rodrigues, V. C. Souza, J. Y. Tamashiro, N. M. Ivanauskas & J. P. Souza 83* (holotype, ESA; isotype, UEC). Figure 2D–F.

Haec species ab *Eugenia mosenii* (Kausel) Sobral racemi rhachidi longa atque bracteis floralibus 6–10 mm (nec 2–3.5 mm) longis caducis ante anthesim differt.

Tree ca. 4 m, branches sparsely puberulous. *Leaf blade* elliptic-obovate or elliptic-oblong, 10–15.8 × 4.1–5.5 cm, chartaceous, subglabrous to sparsely puberulous on adaxial surface, subglabrous to sparsely pubescent on abaxial surface, with simple trichomes, blade apex contracted-acuminate, base attenuate, midvein slightly sulcate, subglabrous to sparsely puberulous on adaxial surface, subglabrous to sparsely pubescent on abaxial surface, lateral veins prominent, marginal vein doubled, the inner one 3–5 mm from the margin; glandular dots slightly impressed to slightly prominent on adaxial surface; petiole 1.5–1.7 cm. *Raceme* axillary, sessile, with 5 to 7 pairs of flowers, rachis 4.5–7.5 cm, densely pubescent, with brownish trichomes; floral bracts deciduous before anthesis, 0.6–1 cm, pedicel 0.7–2.2 cm, densely pubescent, bracteoles 3–3.5 mm, free, not basally connate, apex acute, sparsely pubescent. *Flower bud* 5–8 mm diam., sepals 4–6 mm, apex rounded, pubescent, persistent; petals not observed; stamen filaments not observed; hypanthium very densely furfuraceous, indumentum more evident than indumentum of the calyx lobes, bracteoles, rachis, and pedicel, surface not costate, style not observed. *Fruit* not observed.

Distribution and habitat. *Eugenia longibracteata* is only known from Cunha, in São Paulo State, Brazil, from Atlantic Forest.

IUCN Red List category. *Eugenia longibracteata* is considered Vulnerable (VU D1) according to IUCN Red List criteria (IUCN, 2001).

Discussion. *Eugenia longibracteata* is known from two collections, both with only floral buds, from Cunha, in São Paulo, Brazil. Its floral bracts are caducous, dehiscing before anthesis. The new species has morphological affinity with *E. mosenii*, a species that occurs in Atlantic Forest in São Paulo and Paraná. *Eugenia longibracteata* can be distinguished from *E. mosenii* by its caduous bracts that dehisce before anthesis (vs. bracts persistent on the fruit or deciduous after anthesis), long racemes with rachis 4.5–7.5 cm long (vs. short racemes, generally reduced to fascicles, with rachis 0–0.8 cm long), and long floral bracts (0.6–1 cm vs. 2–3.5 mm long).

Paratype. BRAZIL. **São Paulo:** Cunha, Estação Experimental da Serra do Mar, Morro da Marlene, 23°12′44″S, 45°02′01″W, *A. R. Ferretti, A. Vanini, A. G. Nave, F. M. Peneireiro, R. R. Rodrigues, V. C. Souza, J. Y. Tamashiro, N. M. Ivanauskas & J. P. Souza 152A* (ESA, UEC).

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Two New Species and a Nomenclatural Synopsis of *Myriocarpa* (Urticaceae) from Mesoamerica

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Abstract. *Myriocarpa* Bentham (Urticaceae), a genus endemic to Central and South America, is characterized by string-like pendent pistillate inflorescences. Among Mesoamerican species, there is significant confusion over the application of names, especially *M. bifurca* Liebmann, *M. cordifolia* Liebmann, and *M. heterospicata* Donnell Smith. Two new species from Mesoamerica are described and illustrated: *M. cubilgueitzensis* A. K. Monro and *M. trifurca* A. K. Monro. In addition, a key to the seven species recognized for Mesoamerica and a nomenclatural review are provided. The names *M. bifurca* Liebmann, *M. cordifolia* Liebmann, and *M. longipes* Liebmann are lectotypified, and the name *M. colipensis* Liebmann is neotypified.

Key words: Guatemala, Mesoamerica, Mexico, *Myriocarpa*, Urticaceae.

Myriocarpa Bentham is a genus of shrubs and small trees endemic to Central and South America. Within the Urticaceae, *Myriocarpa* is characterized by its long, pendulous, string-like, spicate, pistillate inflorescences of apparently naked flowers and stems that release a watery latex when cut. Estimates for the size of the genus range from five to 10 (Burger, 1977) to 18 (Friis, 1989) species. Research for *Flora Mesoamericana* suggests that there are probably 15 to 20 species throughout the range of the genus.

The genus was described by Bentham in 1846 based on Colombian material of *Myriocarpa stipitata* Bentham collected by Barclay (Barclay, unpublished). Weddell placed *Myriocarpa* in the Urticaceae tribe Boehmerieae (Weddell, 1856, 1869) despite its anomalous pubescence, cystolith morphology, and wood anatomy. Friis (1989), in his review of the genus's position within the Urticaceae, retained its position within the Boehmerieae, presumably because its position in any other Urticaceae tribe would be equally ambiguous. The position of *Myriocarpa* within the Boehmerieae is not supported by recent phylogenetic analyses of *trnL-F* sequence data (Monro, 2006: fig. 2) that recovered *Myriocarpa* within a strongly supported clade including both the tribes Urticeae and Lecantheae. Its position within either one of these tribes, however, is unresolved. Based on hair, leaf, and flower morphology, *Myriocarpa* could equally well be placed in the Lecantheae (absence of hooked hairs) or the Urticeae (alternate leaves, pistillodes not ejecting the achene). Further research, both molecular and morphological, is clearly warranted.

In the last major revision of the genus, six species were recognized (Weddell, 1869). Since this revision, *Myriocarpa* has attracted little taxonomic interest outside of floristic treatments (e.g., Standley & Steyermark, 1952; Burger, 1977), despite its unusual pistillate inflorescence morphology and ambiguous position within the Urticaceae. Currently, a total of 24 species names have been published (IPNI, 2006).

Materials and Methods

In preparing revisionary accounts of *Myriocarpa* for *Flora Mesoamericana*, 762 North, Central, and South American collections from BM, C, CAS, CR, DS, F, GH, LAGU, LL, MEXU, MO, NY, PMA, TEX, and US were examined. The macro-morphological characters most frequently used by previous authors have been: leaf shape, pistillate inflorescence branching, orientation of "bracts," and pistil and fruit (achene) morphology. In this study, emphasis was also placed on cystolith arrangement and morphology, stipule morphology, pistillate inflorescence disposition, and staminate flower morphology.

The circumscription of a single character, the fused bract/tepal-like structures located at the base of the perigonium, has remained ambiguous. Bentham (1846) ascribed these to the perigonium and so described them as tepals. Weddell (1856), however, ascribed them to the inflorescence axis and described them as bracts (although in modern terms these would be considered bracteoles). From examination of these structures for the preparation of species accounts for *Flora Mesoamericana*, they appear independent of the pedicel and to form an envelope around the constricted base of the ovary. The number of these structures associated with each flower (2, 3, or 4) also corresponds to pistillate tepal numbers frequently encountered in the Urticaceae. In addition, staminate *Myriocarpa* flowers are subtended by a single

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bracteole at the base of the pedicel, and *Myriocarpa* would be unique among Urticaceae genera if it had bracteoles associated with both the base and the apex of the pedicel. They are therefore treated as tepals in this treatment.

Taxonomic Treatment and Key to the Mesoamerican Species of *Myriocarpa*

Myriocarpa Bentham, Bot. Voy. Sulphur 168, t. 55. 1846. TYPE: *Myriocarpa stipitata* Bentham, Bot. Voy. Sulphur 168, t. 55. 1846.

Shrubs or trees to 17 m. Stems without stinging hairs, frequently releasing watery latex when cut. Leaves alternate; stipules intrapetiolar, simple, caducous, rarely persistent; blades with margins toothed to subentire; cystoliths fusiform, frequently appearing branched. Inflorescences unisexual; pistillate and staminate inflorescences few-branched racemes or spikes; pedicels, where present, subtended by inconspicuous bracteoles. Staminate flowers 4-parted, tepals equal, lacking a subapical appendage; pistillode prominent. Pistillate flowers with 2, 3, or 4 equal tepals; stigma foot-shaped. Achene subcompressed, ovoid. Ca. 12 spp., Neotropics.

Key to the Mesoamerican Species of *Myriocarpa*

Distributions for each species are given to state level within Mesoamerica. Global distributions are given to regional level (e.g., South America, West Indies) following *Flora Mesoamericana* protocols (Davidse et al., 1994). Some of the characters in the following keys (e.g., cystoliths) are only visible in dried material. Total flower-bearing branch length is calculated as the sum of the lengths of all the flower-bearing branches within a single inflorescence. Combined with an estimate of flower density, total flower-bearing branch length allows the calculation of the number of flowers in an inflorescence (see below).

Key to Staminate Material

1a. Cystoliths present on abaxial leaf surface.
  2a. Leaves subcoriaceous to chartaceous, adaxial surface not minutely pitted, cystoliths randomly scattered throughout, occasionally perpendicular to veins; petiole 3.5–21 mm. . . . . 6. *M. obovata*
  2b. Leaves membranous to subchartaceous, adaxial surface minutely pitted, cystoliths arranged radially around hair bases and/or glands, perpendicular to veins; petiole 13–98 mm. . . . . 3. *M. cubilgueitzensis*
1b. Cystoliths absent on abaxial leaf surface.
  3a. Adaxial leaf surface with cystoliths randomly scattered, minutely pitted occasionally only in part . . . 4. *M. heterospicata*
  3b. Adaxial leaf surface with cystoliths arranged radially around hair bases and glands, not minutely pitted.
    4a. Plants deciduous; peduncle very densely pubescent, surface completely obscured by hairs which cause it to dry silvery gray in color . . . . . 1. *M. bifurca*
    4b. Plants evergreen, rarely deciduous; peduncle glabrous, pubescent, or densely pubescent, the surface visible or completely obscured by the hairs, where completely obscured by hairs these cause it to dry orange-brown in color.
      5a. Inflorescence < 90 mm . . . . . 7. *M. trifurca*
      5b. Inflorescence ≥ 90 mm.
        6a. Flowers 2–2.75 mm diam. immediately prior to anthesis, stamens 2–3 mm; pedicels 0.13–0.25 mm . . . . . 2. *M. cordifolia*
        6b. Flowers 1.13–2 mm diam. immediately prior to anthesis, stamens 1.25–1.75 mm; pedicels 0.25–0.75 mm . . . . . 5. *M. longipes*

Key to Pistillate Material

1a. Cystoliths present on abaxial leaf surface.
  2a. Leaves subcoriaceous to chartaceous, adaxial surface not minutely pitted, cystoliths randomly scattered throughout, occasionally perpendicular to veins; petiole 3.5–21 mm. Inflorescences 11–150 mm . . .6. *M. obovata*
  2b. Leaves membranous to subchartaceous, adaxial surface minutely pitted, cystoliths arranged radially around hair bases and/or glands, perpendicular to veins; petiole 13–98 mm. Inflorescences 140–300 mm. . .3. *M. cubilgueitzensis*
1b. Cystoliths absent on abaxial leaf surface.
  3a. Adaxial leaf surface with cystoliths randomly scattered throughout . . . . . 4. *M. heterospicata*
  3b. Adaxial leaf surface with cystoliths arranged radially around hair bases and glands.
    4a. Inflorescences coiled or curled in part, especially at the tip, drying very dark brown or almost black to very dark purple, peduncle densely pubescent; plants deciduous . . . . . 1. *M. bifurca*
    4b. Inflorescences not curled or coiled, drying green, green-brown, pale brown, or red-brown to dark brown, but never dark purple, peduncle sparsely pubescent to pubescent; plants evergreen.
      5a. Inflorescence < 2.5 mm diam., flower density 10 to 36 per cm . . . . . 5. *M. longipes*
      5b. Inflorescence ≥ 2.5 mm diam., flower density 36 to 112 per cm.
        6a. Inflorescence 3.5–5.5 mm diam., bearing > 3000 flowers; flower 1.75–2.25 mm . . 2. *M. cordifolia*
        6b. Inflorescence 2.5–3.25 mm diam., bearing < 2000 flowers; flower 1.25–1.5 mm . . . . 7. *M. trifurca*

1. Myriocarpa bifurca Liebmann, Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Math. Afd., ser. 5, 2: 307. 1851. TYPE: Nicaragua. [Masaya:] in Monte Masaija, s.d., *A. S. Oersted 5850* ["*12/47*"] (lectotype, designated here, C 100/99 2).

Myriocarpa malacophylla B. L. Robinson & Bartlett, Proc. Amer. Acad. Arts 43: 50. 1907. TYPE: Guatemala. Zacapa: Gualán, 12 Jan. 1905, *C. C. Deam 361* (holotype, GH).

Discussion. There are two sheets of the type collection at C, both have been numbered *Oersted 5850*. However, they appear to have been collected in different months, one sheet being annotated "12/47" and the other "11/47," and therefore probably represent different collections. The sheet annotated "12/47" has been selected as lectotype.

Habitat and distribution. *Myriocarpa bifurca* is found in disturbed and secondary deciduous broadleaf forest, riparian vegetation, and shade coffee farms, at elevations of 100–1300 m and is distributed from Mexico to Costa Rica (see below).

Selected specimens examined. COSTA RICA. [s. loc.]: *Brenes 6672* (F, NY), *Téllez 4289* (MEXU). **Alajuela:** *Hammel 18751* (BM). **Guanacaste:** *Chavarría 906* (CR), *Flores & Herrera 65* (MO), *Liesner 4968* (CR, MO). **Puntarenas:** *Bello 4386* (CR), *Burger 3911* (F, MEXU, NY), *Haber & Zuchowski 9750* (BM, CR, F), *Haber & Zuchowski 10538* (BM), *Haber & Zuchowski 10471* (MO), *Haber & Zuchowski 10490* (BM), *Haber & Zuchowski 10459* (BM). EL SALVADOR. [s. loc.]: *Seiler 1179* (F). **Ahuachapán:** *Monro et al. 1901* (BM), *Sandoval et al. s.n. [JBL839]* (F), *Sermeno s.n. [JBL 1033]* (BM, LAGU, MO), *Standley 19937* (NY, US). **Cabañas:** *Davidse et al. 37073* (BM). **La Libertad:** *Calderón & Berendsohn s.n. [JBL569]* (MO), *Carlson 72* (F), *Williams & Molina R. 15248* (F), *Cruz & Berendsohn 458* (BM, LAGU), *Monro et al. 2295* (BM), *Montalvo & Villacorta 6459* (F), *Sidwell et al. 473* (BM), *Standley 19148* (NY). **Morazán:** *Calderón 1951* (US). **San Miguel:** *Monro et al. 2078* (BM), *Tucker 966* (F, LL, NY). **San Salvador:** *Sidwell et al. 600* (BM). **San Vicente:** *Standley 21671* (NY). **Santa Ana:** *Harmon & Fuentes 4957* (MO). GUATEMALA. [s. loc.]: *Williams et al. 23784* (F). **Huehuetenango:** *Castillo C. & Castillo 2164* (C, F). **Jalapa:** *Kellerman 6454* (F, US). **Quetzaltenango:** *Steyermark 33833* (F). **Retalhuleu:** *Standley 88131* (US), *Steyermark 88154* (F). **Santa Rosa:** *Kellerman 7758* (MEXU, US). **Zacapa:** *Steyermark 42725* (F, US). HONDURAS. [s. loc.]: *Allen 6464* (F, PMA). **Francisco Morazán:** *Molina R. 792* (F), *Nelson & Vargas 3479* (MO). **Santa Bárbara:** *Standley & Lindelie 7538* (F). MEXICO. **Chiapas:** *Breedlove 30626* (MEXU, MO), *Breedlove 23945* (MO), *Breedlove & Thorne 30386* (MEXU), *Langman 3814* (US), *Laughlin 2995* (F, MEXU), *Matuda 5476* (LL, MEXU), *Matuda 18750* (F), *Palacios E. 251* (MEXU), *Palacios E. 308* (MEXU), *Reyes G. et al. 1561* (BM), *Reyes G. et al. 1693* (BM). **Oaxaca:** *Martinez R. 329* (BM, MEXU). NICARAGUA. **Estelí:** *Krukoff & Stevens 5765* (BM, MEXU, MO), *Moreno 25324* (BM, MO), *Moreno 15316* (BM, MEXU), *Moreno 19935* (MO), *Moreno 14054* (BM, MO), *Moreno 19967* (BM, MO). **Granada:** *Moreno 6322* (MO), *Moreno 6365* (BM, MO), *Moreno 419* (BM, MO). **Jinotega:** *Araquistain & Moreno 1625* (BM, MO). **Madriz:** *Stevens et al. 16033* (MO). **Managua:** *Croat 39054* (MO), *Garnier A. 504* (F, US), *Sandino 310* (BM, MO), *Standley 8363* (F). **Masaya:** *Araquistain & Moreno 589* (BM, MO), *Moreno 6139* (BM, MO), *Moreno & López 7174* (MO), *Neill 3071* (BM, MO), *Oersted 21722* (MO photo ex B, F photo ex B), *Oersted 5850* (C, MO, US), *Seymour 3308* (F), *Stevens & Krukoff 5261* (BM, MEXU, MO). **Matagalpa:** *Moreno 22625* (BM, MO). **Nueva Segovia:** *Moreno 19448* (MO), *Moreno 13727* (MO).

2. Myriocarpa cordifolia Liebmann, Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Math. Afd., ser. 5, 2: 306. 1851. TYPE: Mexico. Veracruz: Colipa, s.d., *F. M. Liebmann 14226* (lectotype, designated here, C 100/99 4; isotypes, F fragm. at US).

Myriocarpa colipensis Liebmann, Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Math. Afd., ser. 5, 2: 306. 1851. TYPE: Mexico. Veracruz: Mun. de Coatzintla, Palmar de Zapata, 110 m, 25 Jan. 1982, *Cortés V. 107* (neotype, designated here, NY; isotype, MEXU not seen).

Myriocarpa brachystachys S. Watson, Proc. Amer. Acad. Arts 26: 152. 1891. TYPE: Mexico. Jalisco: barranca, near Guadalajara, 21 May 1889, *C. G. Pringle 3024* (holotype, US not seen; isotypes, NY, VT not seen).

Discussion. The collection selected as lectotype for *Myriocarpa cordifolia* was designated a lectotype through an annotation by Dennis Woodland (in sched.) in 1984. The collection selected as lectotype was made on the basis that it was cited by Liebmann in the original species description, that the sheet selected had been annotated by Liebmann, and that this was the duplicate with the most fertile material.

No type specimen was cited in the original description of *Myriocarpa colipensis*, and no material annotated by Liebmann with this epithet and locality has been located at C or elsewhere. For this reason, a neotype has been designated. This collection was selected because it includes pistillate inflorescences, is in a good state of preservation, and originates from the same state in Mexico (Veracruz) as the locality given for this species by Liebmann (Colipa).

Habitat and distribution. *Myriocarpa cordifolia* is found in riparian vegetation; disturbed and undisturbed wet tropical-, montane-, and cloud-forest; and oak-pine-liquid amber forest formations, from sea level to 2500 m, from Mexico to Costa Rica.

Selected specimens examined. COSTA RICA. [s. loc.]: *Leon 546* (F, MO), *Skutch 3521* (NY), *Skutch 3527* (US). **Alajuela:** *Smith 1553* (NY). **Cartago:** *Barringer et al. 2262* (CR, F, LL), *Utley & Utley 2132* (F, LL). **Heredia:** *Garwood et al. 392* (BM, F, MEXU), *Gomez P. 2156* (F), *McDowell 934* (F, TEX). **Puntarenas:** *Bello 709* (BM, CR, MO), *Haber & Zuchowski 9805* (MO). **San José:** *González E. 158* (F), *Grayum & Stiles 5309* (BM, CR, MEXU, MO), *Maas & Hammel 7949* (BM, CR, F, MO), *Standley 36488* (US),

Standley 37819 (US), *Taylor 17928* (NY, US), *Utley & Utley 626* (MO), *Wilbur 24466* (MO). GUATEMALA. **El Quiche:** *Contreras 5202* (F, LL), *Proctor 25390* (F, LL). **Huehuetenango:** *Breedlove 11677* (LL). **Santa Rosa:** *Standley 79344* (F). MEXICO. **Chiapas:** *Breedlove 49659* (MEXU), *Breedlove 9415* (F), *Matuda 278* (MEXU), *Méndez T. 5305* (MEXU), *Shilom T. 2088* (NY), *Breedlove 8966* (F), *Shilom T. 3976* (LL), *González G. 219* (TEX), *Reyes G. et al. 1605* (BM, MEXU), *Xolocotzi & Sharp X-469* (MEXU). **Jalisco:** *Pringle 4735* (BM), *Pringle 3024* (NY). **Michoacán:** *Labat 1601* (MEXU). **Temascaltepec:** *Hinton et al. 3780* (BM). **Veracruz:** *Cortés V. 107* (NY), *Liebmann 14226* (C, F, US), *Nee et al. 29714* (BM, F, MO, NY, TEX, XAL), *Nee & Calzada 22680* (NY), *Ventura A. 4755* (TEX).

3. Myriocarpa cubilgueitzensis A. K. Monro, sp. nov. TYPE: Guatemala. Alta Verapaz: pantanó, 2.5 mi. W of Cubilgüitz, 250–300 m, 28 Feb. 1942, *J. A. Steyermark 44346* (holotype, US). Figure 1.

Species nova *Myriocarpae obovatae* Donnell Smith similis, sed ab ea foliis membranaceis subchartaceisve supra minute foveolatis atque petiolo saepe longiore, cystolithis radialiter dispositis et inflorescentiae pistillatae ramulis majoribus differt.

Shrub or tree to 9 m, evergreen. Young shoots pubescent to sparsely pubescent, the hairs 0.25–0.5 mm, erect or appressed, weakly curved, straight, or crooked; internodes 6–25 × 2.5–4 mm. Stipules 5–11 mm; petioles 13–98 × 1–2 mm, petioles of younger leaves pubescent, becoming glabrous, the hairs 0.5–0.75 mm; leaf blade 80–206 × 32–79 mm, obovate, rhombic, oblanceolate, or ovate, membranous to subchartaceous; adaxial surface minutely pitted, glabrous, the cystoliths fusiform and V-shaped fusiform, arranged radially around hair bases and/or glands, perpendicular to veins; abaxial surface sparsely pubescent to glabrous, the hairs when present ca. 0.75 mm, appressed, weakly appressed, or erect, weakly curved, straight, or crooked, cystoliths fusiform, V-shaped fusiform, and X-shaped fusiform, arranged radially around hair bases and/or glands, perpendicular to veins; principal veins 3, lateral principal veins visible for 1/2–2/3 of leaf length, secondary veins 2 to 4 pairs, forming a 30°–60° angle with the midrib, domatia absent; base acute or obtuse to cuneate; margins serrate toward apex, basal 1/10–1/5 entire; apex cuspidate or subcuspidate. Staminate inflorescences 20–110 mm, a single order of branching, with a total flower-bearing branch length of 15–122 mm; peduncular bracts 2–2.5 mm; peduncle glabrous to sparsely pubescent, the hairs 0.25–0.375 mm; flowers sessile to subsessile. Pistillate inflorescences 1 to 5 per stem, pendent, 140–300 × 3–4 mm, bearing 1083 to 2950 flowers, pale green-gray when fresh, pale brown when dry, dichotomously and/or trichotomously branched 1 or 2×, with a total flower-bearing branch length of 550–770 mm and flower density of 16 to 50 per cm; peduncular bract ca. 1 mm; peduncle 11–30 mm, sparsely pubescent to glabrous, when pubescent the hairs ca. 0.25 mm, erect, straight; flowers pedicellate to subsessile, pedicels where present 0.13–0.25 mm. Staminate flowers 0.75–1 × 1.5–2 mm immediately prior to anthesis, tepals 1.5–1.75 mm; stamens ca. 2 mm. Pistillate flowers/fruit 1.75–2.5 × 0.68–1 mm; tepals 2, 0.75–1 mm, appressed; ovary 0.75–1 mm, ellipsoid, constricted from base for 1/3–1/2 of length, sparsely to moderately pubescent, the hairs 0.25–0.5 mm; style 0.5–0.75 mm; stigma very strongly asymmetrical.

Habitat and distribution. *Myriocarpa cubilgueitzensis* is found in lowland forest in rocky areas and in riparian vegetation. It is distributed in northern Mesoamerica, Mexico (Chiapas, Oaxaca, Tabasco, Veracruz), and Guatemala (Alta Verapaz) at elevations of 130–600 m.

IUCN Red List category. Conservation for *Myriocarpa cubilgueitzensis* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001), owing to the fact that the species has been collected 11 times in several localities in Mexico and Guatemala.

Etymology. The species is named after the locality of the type collection.

Discussion. *Myriocarpa cubilgueitzensis* most closely resembles *M. obovata* Donnell Smith in the presence of cystoliths on the abaxial leaf surface (these unique to these two species) and the pale green-gray (when fresh), strongly bilaterally compressed pistillate flowers. Material of this species has frequently been determined as *M. heterospicata* Donnell Smith. The three species may be distinguished from each other as follows: (1) in *M. cubilgueitzensis*, cystoliths present on abaxial leaf surface, adaxial surface minutely pitted, cystoliths arranged radially around hair bases and/or glands, perpendicular to veins; leaves membranous to subchartaceous; petiole 13–98 mm; pistillate inflorescence 140–300 mm; (2) in *M. heterospicata*, cystoliths absent from abaxial leaf surface, adaxial surface minutely pitted, cystoliths randomly scattered throughout or occasionally radially around hair bases and/or glands; leaves chartaceous; petiole 6.5–125 mm; pistillate inflorescences 62–330 mm; and (3) in *M. obovata*, cystoliths present on abaxial leaf surface, adaxial surface not minutely pitted, cystoliths randomly scattered throughout, occasionally perpendicular to veins; leaves subcoriaceous to chartaceous;

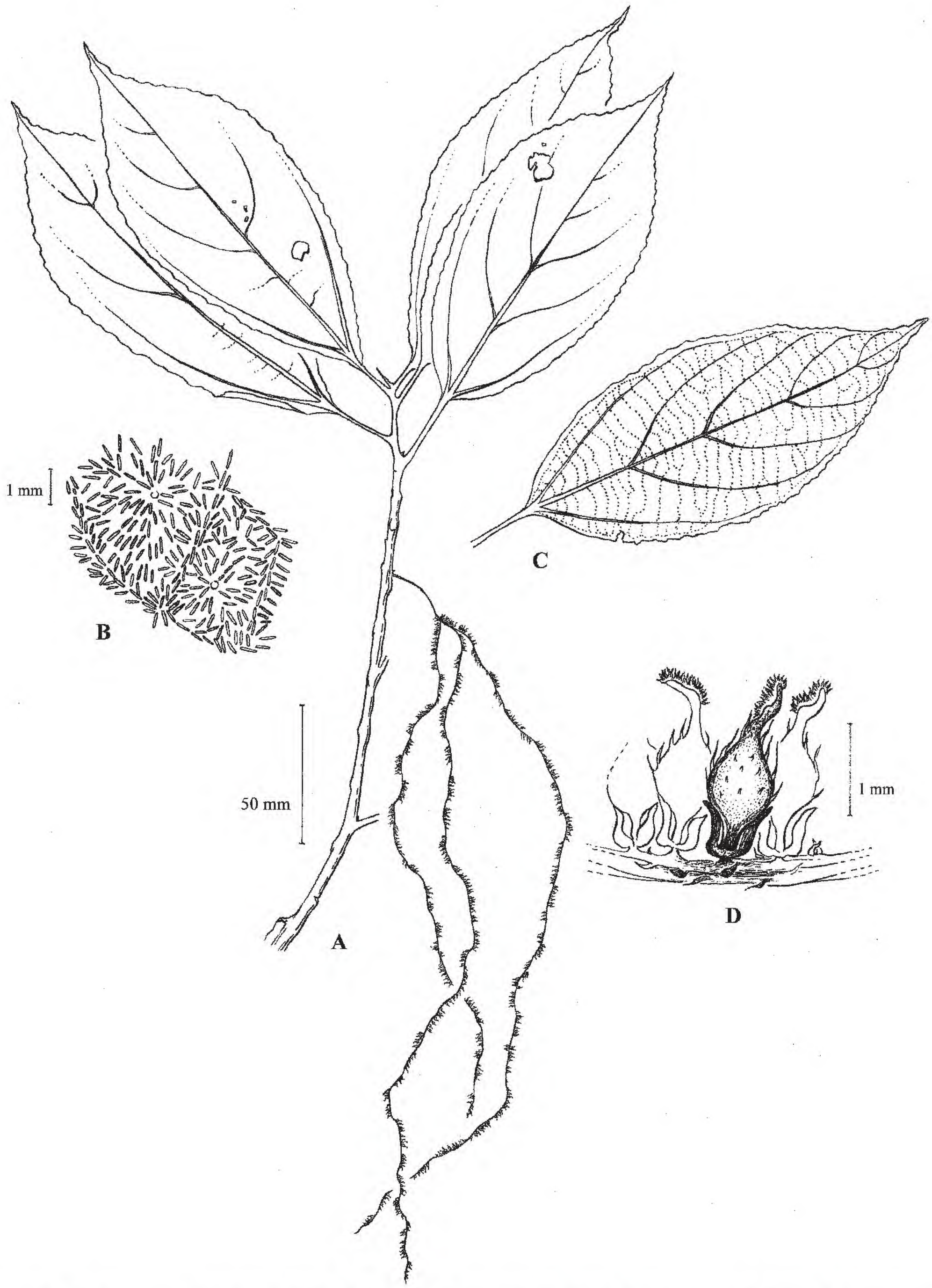

Figure 1. *Myriocarpa cubilgueitzensis* A. K. Monro. —A. Habit, with pistillate inflorescence. —B. Cystolith arrangement of abaxial leaf surface. —C. Leaf, abaxial surface. —D. Pistillate flowers. A–D drawn from the holotype, *J. A. Steyermark 44346* (US).

petiole 3.5–21 mm; pistillate inflorescence 11–150 mm.

Paratypes. GUATEMALA. **Alta Verapaz:** Cubilgüitz, *H. von Tuerckheim 7982* (NY, US); above slopes of waterfall, along Río Icvolay, N & NW of Finca Cubilgüitz to Quebrada Diablo, 300–350 m, 6 Mar. 1942, *J. A. Steyermark 44778* (F, US). MEXICO. **Chiapas:** Mun. Ocosingo, *M. Martínez-Icó 361* (MEXU). **Oaxaca:** Chimalapa, Mun. Santa María Chimalapa, Piedra Blanca (Popotzá), al S de la vereda al Río Blanca ca. 7 km al E de Santa María, *H. Hernández G. 745* (LL); Distr. de Ixtlán, Mun. Yolox along rd. betw. Yolox & Comâltepec at river crossing closest to Yolox, *G. J. Martin 405* (BM). **Tabasco:** Mun. Teapa, Sierra El Madrigal, a 600 E del edificio principal del Centro Regional Tropical Puyacatengo, *A. M. Hanan A. 607* (MEXU). **Veracruz:** Mun. Hidalgotitlán, camino campamiento hermanos Cedillo-Plan de Arroyo, *J. Dorantes & C. Castillo 3628* (TEX, XAL not seen); Mun. Minatitlán, 12 km NE de Uxpanapa (Poblado 12) sobre camino a Díaz Ordaz, loma NW del Poblado 13, *T. Wendt, A. Villalobos C. & I. Navarrete* 3695 (MO); Mun. Minatitlán, lomas al S del Poblado 11, ca. 27 km E de La Laguna, cima de una loma al NNE de la loma grande, *T. Wendt, A. Villalobos C. & I. Navarrete 3127* (MO); Mun. Minatitlán, 6.4 km N de la terracería La Laguna–Uxpanapa sobre el camino nuevo brecha 93 a Belisario Domínguez, *T. Wendt, A. Villalobos C. & I. Navarrete 4281* (MO).

4. Myriocarpa heterospicata Donnell Smith, Bot. Gaz. (Crawfordsville) 12: 133. 1887. TYPE: Guatemala. Alta Verapaz: Pansmalá, 1160 m, Mar. 1886, *von Türckheim 892* (holotype, US; isotype, GH).

Myriocarpa heterostachya Donnell Smith, Bot. Gaz. (Crawfordsville) 13: 29. 1888, nom. illeg., non *Myriocarpa heterospicata* Donnell Smith.

Discussion. Donnell Smith (1888) sought to correct his hybrid (Latin-Greek) species epithet *heterospicata* by superfluously publishing *Myriocarpa heterostachya* Donnell Smith, which has subsequently been widely used in error.

Habitat and distribution. *Myriocarpa heterospicata* is found in disturbed and undisturbed evergreen wet forest, cloud forest, or oak-pine-liquid amber forest formations from Mexico to Nicaragua at elevations of 100–1800 m. Material from the Atlántida Department in Honduras (*Liesner 26318* [BM, MO], *Yuncker 8477* [BM, F, MO, NY, US], and *Yuncker 8761* [F, NY]) is notable for having significantly longer (to 33 cm) and more floriferous (to 2400 flowers) pistillate inflorescences than other material from Mesoamerica.

Selected specimens examined. BELIZE. [s. loc.]: *Whitefoord 1118* (BM, MEXU, MO). **Toledo:** *Schipp 1033* (BM, F, MO, NY), *Gentle 6647* (F, LL). GUATEMALA. [s. loc.]: *Skutch 895* (BM, NY, US). **Alta Verapaz:** *Smith 1645* (NY), *Standley 70302* (BM, F, US), *Standley 70099* (F), *Standley 89901* (F, TEX), *Steyermark 44187* (F), *Steyermark 43919* (F), *Tenorio L. et al. 14703* (BM), *Tuerckheim 1350* (NY), *Tuerckheim II/1353* (BM, F, MO, NY), *Tuerckheim 892* (GH, US), *Williams et al. 40159* (F, US), *Williams et al. 40201* (BM, F, NY), *Williams et al. 43648* (BM, F, US), *Wilson 40846* (F), *Wilson 40586* (F). **Escuintla:** *Standley 63385* (F), *Standley 89583* (F). **Huehuetenango:** *Steyermark 49507* (F, US). **Petén:** *Contreras 6674* (LL), *Contreras 10061* (F, LL), *Contreras 3548* (LL), *Contreras 10636* (F), *Lundell & Contreras 20104* (LL), *Lundell 17759* (LL), *Lundell 16261* (F, LL), *Smith 6674* (BM), *Steyermark 46073* (F, LL), *Zomer 133* (F). **Quezaltenango:** *Roe et al. 722* (BM, F). **San Marcos:** *Croat 40799* (MEXU, MO). **Suchitepéquez:** *Standley 66867* (US). HONDURAS. **Atlántida:** *Liesner 26318* (BM), *Yuncker et al. 8761* (F, NY), *Yuncker et al. 8477* (BM, F, MO, NY, US). **Comayagua:** *Molina R. 10866* (F), *Molina R. 5824* (F), *Molina R. 5834* (F), *Molina R. 10880* (F), *Yuncker et al. 6332* (F, MO), *Yuncker et al. 5998* (F, MO). **Copán:** *Molina R. & Molina 30782* (F). MEXICO. [s. loc.]: *Breedlove 49023* (MEXU), *Matuda 4318* (MEXU, MO), *Mejia et al. 43* (MEXU). **Chiapas:** *Breedlove 33068* (F), *Breedlove 23847* (MO, NY), *Breedlove 57964* (MEXU), *Breedlove 33881* (MO), *Breedlove 9711* (F, LL), *Breedlove & Thorne 21397* (MEXU, MO, NY), *Cabrera & Cabrera 3886* (MEXU), *Croat & Hannon 65129* (MEXU, MO), *Duran & Levy 440* (MEXU), *Hampshire & Reyes G. 1226* (BM, F), *Langman 3878* (BM), *Levy & Durán 318* (MEXU), *Martinez 1986* (BM, MO), *Matuda 18135* (F, MEXU), *Matuda 18080* (F, MEXU), *Matuda 4037* (F), *Mejia et al. 712* (MEXU), *Mendez T. & Mtz. de López 9492* (MEXU, TEX), *Mendez T. et al. 6562* (BM), *Mendez T. & Shilom A. 7177* (BM), *Mendez T. et al. 4999* (BM), *Mendez T. et al. 5176* (BM), *Mendéz T. 6470* (MEXU), *Miranda 7697* (MEXU), *Miranda 5808* (MEXU), *Miranda 5153* (MEXU), *Narave F. 1286* (MEXU), *Shilom T. 1406* (US), *Shilom T. 3643* (MEXU, NY). **Tabasco:** *Magaña & Zamudio 870* (MEXU), *Ventura A. 21482* (MEXU). **Veracruz:** *Cedillo T. 2501* (BM), *Nee & Taylor K. 29414* (BM, NY), *Purpus 16265* (F, TEX, US). NICARAGUA. **Estelí:** *Grijalva 960* (BM, MO), *Martinez & Grijalba 1901* (BM), *Moreno 19426* (MO). **Jinotega:** *Henrich & Stevens 235* (BM, MO), *Moreno 7694* (BM, MO), *Sandino 1021* (BM, MO), *Standley 10727* (F), *Stevens & Krukoff 21843* (BM). **Matagalpa:** *Gentry et al. 44042* (MO), *Gentry et al. 44063* (MO), *Grijalva et al. 3027* (MO), *Guzman et al. 886* (BM, MO), *Krukoff & Stevens 23023* (BM, MEXU, MO), *Krukoff & Stevens 23024* (BM, C), *Krukoff & Stevens 23025* (MO), *Moreno 17011* (BM, MEXU, MO), *Molina R. 22885* (BM, F, MO, NY), *Molina R. 30549* (MO), *Nee 27659* (BM, MEXU, MO), *Neill 829* (BM, MO), *Stevens et al. 21313* (BM, MO), *Stevens et al. 21312* (BM, MO), *Stevens et al. 20327* (BM, MO), *Tomlin 22* (BM, MO), *Williams et al. 23417* (F, MEXU).

5. Myriocarpa longipes Liebmann, Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Math. Afd., ser. 5, 2: 306. 1851. TYPE: Costa Rica. Alajuela: Monte Aguacate, Nov. 1846, *Oersted s.n.* [*5851*] (lectotype, designated here, C [100/99-22]; isotype, US).

Myriocarpa inaequilateris Liebmann, Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Math. Afd., ser. 5, 2: 307. 1851. TYPE: Costa Rica. Alajuela: Monte Aguacate, Nov. 1846, *Oersted 14338* (lectotype, designated here, C [100/99-12], C photo at F).

Myriocarpa magnifica Rusby, Descr. S. Amer. Pl. 11. 1920. TYPE: Colombia. Magdalena: Santa Marta, near Cacagualita, 460–610 m, 23 Dec. 1898, *H. H. Smith 1422* (holotype, NY image seen; isotypes, BM, GH, US).

Myriocarpa yzabalensis (Donnell Smith) Killip, Proc. Biol. Soc. Wash. 40: 29. 1927. Basionym: *Myriocarpa longipes* Liebmann var. *yzabalensis* Donnell Smith, Bot. Gaz. (Crawfordsville) 16: 13. 1891. TYPE: Guatemala. Izabal: Monte Cachirulo, 240 m, Apr. 1889, *J. Donnell Smith 1644* (holotype, US).

Discussion. The collection selected as lectotype for *Myriocarpa longipes* was designated a lectotype through an annotation by Dennis Woodland (in sched.) in 1984. This typification was, however, never published. The collection selected as lectotype was made on the basis that it was cited by Liebmann in the original species description and that this was the duplicate with the most fertile material.

The collection selected as lectotype for *Myriocarpa inaequilateris* was designated a lectotype through an annotation by Dennis Woodland (in sched.) in 1984. This typification was, however, never published. The collection selected as lectotype was made on the basis that it was cited by Liebmann in the original species description.

Habitat and distribution. *Myriocarpa longipes* is found in disturbed, undisturbed, and secondary evergreen wet forest, essentially streamside or riverside, from sea level to 2400 m, and is distributed from Mexico to South America (Colombia, Bolivia, Brazil).

This species is very variable for leaf shape size and fruit color. Leaf shape varies from ovate to lanceolate, elliptic, or oblanceolate to obovate, encompassing the full range of shapes and dimensions of other Mesoamerican *Myriocarpa* species. The black shiny fruit cited by Donnell Smith as one of the diagnostic characters for *M. longipes* var. *yzabalensis* (later raised to specific rank by Killip) appears to be variable within Central American species. For example, it also occurs in some collections of *M. heterospicata*, and it may be that it is associated with the maturity of the fruit.

Selected specimens examined. [s. loc.]: *Oersted A. 14346* (C). BELIZE. [s. loc.]: *Schipp 1178* (BM, F, NY), *Schipp 8472* (F). **Cayo:** *Gentle 2223* (LL, MEXU, NY, US), *Hawkins 1277* (BM). **Stann Creek:** *Dwyer et al. 555* (MO), *Gentle 2849* (NY), *Gentle 3179* (NY). **Toledo:** *Croat 24329* (MO), *Gentle 7178* (LL), *Gentle 5288* (LL, MEXU), *Gentle 5490* (LL), *Whitefoord 1830* (BM), *Whitefoord 1582* (BM, MEXU), *Stevenson 14494-91* (F), *Stevenson 14894-112* (F). COSTA RICA. [s. loc.]: *Burger & Matta U. 4211* (F), *Burger & Matta U. 4748* (NY), *Burger & Matta U. 4657* (F), *Leon 606* (F), *Mier 1926* (C), *Mier 1612* (C), *Smith 6776* (NY), *Valerio 396* (F). **Alajuela:** *Brenes 6568* (F), *Brenes 6584* (F, NY), *Brenes 6536* (F, NY), *Guild & Herrera 3* (BM), *Haber 1523* (MO), *Haber ex Bello C. 6427* (MO), *Herrera C. 1007* (BM, CR), *Herrera C. et al. 429* (BM), *Jimenez M. 1719* (F, NY, US), *Molina R. et al. 17405* (F, NY, US), *Oersted A. 5851* (F, US), *Smith 1423* (MO, NY), *Utley & Utley 3984* (F), *Utley & Utley 3895* (F, MO), *Utley & Utley 3950* (F, MO), *Burger et al. 11652* (BM, CR, F, NY). **Cartago:** *Lent 3622* (F), *Lems 5055* (NY), *Little 20063* (CR), *Polakowsky 486* (BM), *Taylor 18035* (NY). **Guanacaste:** *Garwood et al. 809* (BM), *Grayum & Herrera 4835* (BM, MEXU), *Martin 3727* (BM), *Tebbs & Vickery 1063* (BM, MO). **Heredia:** *Folsom 8784* (F, TEX), *Frankie 69c* (BM), *Grayum 2227A* (F), *Grayum 2227B* (TEX), *McDowell 1087* (F), *Vargas 272* (BM). **Limón:** *Burger et al. 10333* (NY), *Burger & Liesner 6993* (BM), *Antonio 609* (F), *Burger & Antonio 11292* (MEXU), *Quiros 506* (F), *Robles 1449* (BM), *Robles 2652* (BM, CR, F). **Puntarenas:** *Allen 5739* (DS, F), *Burger & Gentry L 8872A* (F), *Burger & Swagel 12273* (F), *Castro 214* (MO), *Castro 203* (MO), *Castro 83* (MO), *Cordero 163* (MO), *Cordero 86* (BM, MO), *Delprete 5175* (TEX), *Haber & Zuchowski 11270* (BM, MO), *Haber 1340* (MEXU, MO, TEX), *Haber 11020* (MO), *Jimenez et al. 1495* (BM, MO), *Kernan 17* (BM, CR, F), *Lent 3075* (F), *Maas et al. 7889* (BM), *Raven 20860* (F, MO), *Skutch 1947* (CR), *Skutch 5379* (CR), *Smith 6775* (BM, NY), *Tonduz 4826* (BM). **San José:** *Burger & Barringer, K. 11621* (CR, F), *Morales et al. 1126* (BM), *Skutch 2320* (MO, NY), *Skutch 2321* (NY), *Téllez et al. 4228* (MEXU), *Williams et al. 28451a* (F, NY), *Zamora & Carlson 419* (MEXU). GUATEMALA. **Alta Verapaz:** *Croat 41595* (MO, US), *Croat 41594* (MO), *Choc & Stewart 36* (CAS), *Goll 223* (NY). **Chimaltenango:** *Standley 80161* (F). **El Quiché:** *Ventur 227* (F). **Izabal:** *Contreras 11544* (LL), *Johnson 1262* (US), *Kellerman 7319* (NY, US), *Kellerman s.n. [125402]* (MEXU), *Smith 1644* (US), *Stevens et al. 25498* (BM), *Steyermark 41791* (US), *Steyermark 41824* (F), *Steyermark 39952* (F, US), *Steyermark 38263* (F), *Steyermark 39091* (F), *Steyermark 41840* (F). **Petén:** *Contreras 6630* (F, LL), *Contreras 9298* (LL), *Tun O. s.n.* [US 2735523] (US), *Tun O. 1489* (BM). **Quetzaltenango:** *Standley 67218* (F), *Standley 85087* (F), *Standley 65355* (F). **Sacatepéquez:** *Standley 88993* (F). **San Marcos:** *Croat 40801* (MEXU, MO), *Dwyer 14403* (BM, MO), *Standley 86275* (F). HONDURAS. [s. loc.]: *Wilson 253* (NY). **Atlántida:** *Barkley & Hernández M. 40035* (TEX), *Croat & Hannon 64621* (BM, MO), *Liesner 26401* (BM), *Standley 52953* (F), *Standley 54061* (US), *Standley 54626* (F). **Comayagua:** *Edwards P-454* (F), *Molina R. 10843* (F, NY). **Gracias a Dios:** *Saunders 1193* (NY). **Yoro:** *Hazlett 3157* (BM, F, MEXU). MEXICO. [s. loc.]: *Hanan 290* (MEXU), *Juzepczuk 1925-26* (F), *Mendez T. 9581* (MEXU). **Chiapas:** *Bossé 8474* (F), *Breedlove 11085* (LL), *Breedlove & Smith R. 22132* (MEXU, MO), *Breedlove 14922* (LL, US), *Breedlove 23969* (LL, MO), *Breedlove 8844* (F, LL), *Breedlove 24226* (MEXU), *Breedlove 21924* (LL), *Brett 280* (TEX), *Burnham 10* (BM), *Chavelas P. et al. 691* (MEXU), *Chavelas P. et al. 1286* (MEXU), *O. F. Clarke 224* (NY), *Croat & Hannon 65220* (BM), *Flores C. & Espejo 546* (MEXU), *Fuentes s.n. "Ene 24 1955, 50270"* (MEXU), *Hernández G. 705* (LL), *Hoover 140* (MO), *Juzepczuk 1805* (F), *Laughlin 287* (F, LL), *Mendez T. et al. 5470* (BM), *Mendez G. 8052* (BM), *Martinez S. 17054* (BM, MEXU), *Martinez S. 17805* (BM), *Martinez S. et al. 3138* (BM, MEXU), *Sánchez s.n. "9 Nov 1977"* (TEX), *Shilom T. 2906* (LL), *Spellman et al. 193* (MO), *Ventura L. 2842* (MEXU). **Tabasco:** *Cowan & Zamudio 3361* (MO, NY), *Croat et al. 65348* (MEXU), *Martinez S. 34708* (BM). **Veracruz:** *Fay & Hernandez 829* (NY, US), *Gentry et al. 32306* (MO), *Hernandez O. 50* (MEXU), *Ibarra M. 2267* (MO), *Ibarra M. 789* (MO), *Martinez C. 1745* (MO, NY), *Nee & Taylor 29888* (MO, NY), *Perino & Perino 3102* (NY), *Sinaca C. 800* (MO), *Soto & Horvitz 47* (NY), *Williams 8559* (US), *Williams 8403* (US), *Vázquez Y.*

411 (MO). NICARAGUA. [s. loc.]: *Baker 72* (DS, MO, NY), *Englesing 64* (F), *Tate 392* (BM). **Boaco:** *Moreno 20196* (BM, MO), *Moreno 20275* (MO). **Chinandega:** *Shimek & Smith 4* (F). **Chontales:** *Gentry et al. 43949* (BM, MO), *Grijalva & Bradford 3643* (BM, MO, NY), *Sandino 5103* (BM, MO), *Stevens & Krukoff 6147* (BM, MO), *Vincelli 96* (BM, MO). **Jinotega:** *Atwood et al. 6899* (F, MO), *Stevens & Krukoff 16625* (BM, MO), *Stevens & Krukoff 16460* (BM, MO). **Managua:** *Garnier A. 346* (US), *Grant 1046* (US). **Masaya:** *Standley 8714* (F), *Standley 8733* (F). **Matagalpa:** *Araquistain & Moreno 2721* (BM, MO), *Araquistain & Moreno 2579* (MO), *Castro 2272* (BM, MO), *Stevens & Krukoff 11880* (BM, MEXU, MO), *Stevens et al. 21212* (BM, MO), *Stevens et al. 21211* (MO), *Stevens et al. 20977* (BM, MO), *Williams et al. 23845* (NY). **Río San Juan:** *Moreno 23221* (BM, MO), *Neill & Vincelli 3577* (BM, MO), *Neill 3343* (BM, MEXU, MO). **Rivas:** *Moreno 19646* (MO), *Sandino 4113* (BM, MO), *Stevens & Krukoff 6600* (BM, MO). **Zelaya:** *Krukoff & Stevens 18787* (BM, MO), *Krukoff & Stevens 6302* (BM, MO), *Little 25324* (MO, US), *Moreno 15000* (BM, MO), *Moreno 19128* (BM, MO), *Moreno 14762* (BM, MEXU, MO), *Moreno & Robleto 20666* (BM, MO), *Moreno & Sandino 14965* (BM, MO), *Neill 4135* (MO), *Ortiz 546* (MO), *Ortiz 627* (BM, MO), *Ortiz 745* (BM), *Ortiz 1500* (BM, MO), *Ortiz 573* (MO), *Ortiz 1654* (BM, MO), *Ortiz 906* (MO), *Ortiz 1538* (BM, MO), *Pipoly 4712* (BM, MO), *Pipoly 5895* (MO), *Pipoly 3532* (BM, MO), *Pipoly 4957* (MO), *Pipoly 6114* (BM, MO), *Pipoly 4864* (BM, MO), *Pipoly 3752* (BM, MO), *Pipoly 4607* (BM, MO), *Stevens & Krukoff 6813* (BM, MO), *Stevens & Krukoff 12660a* (MO), *Stevens & Krukoff 12057* (BM, MEXU, MO), *Sandino 2411* (MO), *Stevens & Krukoff 12568* (BM, MO), *Stevens & Krukoff 13085* (MO), *Stevens & Krukoff 6895* (BM, MO), *Stevens & Krukoff 13052* (BM, MEXU, MO), *Stevens & Krukoff 19384* (BM, MO), *Stevens & Krukoff 6828* (BM, MO), *Vincelli 239* (BM, MO), *Vincelli 137* (BM, MO), *Vincelli 205* (BM, MO). PANAMA. [s. loc.]: *Cowell 113* (NY), *Piper 5841* (C, US), *Seemann 1575* (BM). **Bocas del Toro:** *Correa et al. 3396* (F), *Dunlap 300* (F), *Oliver 950* (NY), *McPherson 6763* (MEXU, MO, TEX), *Proctor 414* (F, NY), *Wedel 1692* (MO), *Wedel 1411* (MO), *Wedel 1505* (MO). **Chiriquí:** *D'Arcy et al. 13009* (BM), *Davidson 488* (F); *Pittier 5157* (NY, US), *Stevens et al. 18432* (BM), *Terry & Terry 1646* (F). **Coclé:** *Allen 4218* (US), *Dwyer 11852* (NY), *Hamilton & Davidse 2790* (MEXU, MO), *Sytsma & D'Arcy 3622* (MEXU, MO). **Colón:** *Churchill W. & de Nevers 4232* (MEXU), *Gentry 6727* (MO), *Antonio 3334* (LL), *Salazar 44* (F), *Pittier 2487* (BM, NY), *Knapp & Schmalzel 3603* (LL), *Antonio 3834* (BM), *Nee 7146* (US). **Darién:** *D'Arcy & McPherson 16219* (MEXU), *D'Arcy & Sytsma 14464* (MO), *Garwood et al. 27* (BM), *Knapp & Mallet 3038* (LL), *McDonagh 520* (BM), *Nee 9110* (LL), *Whitefoord & Eddy 137* (BM), *Whitefoord & Eddy 196* (BM), *Reveal & Duke 4860* (MO). **Kuna Yala:** *Bangham 586* (F), *D'Arcy 13651* (BM, MEXU), *Hamilton & Stockwell 2941* (MEXU, MO). **Panamá:** *Aviles 27* (F), *Brown 47* (F), *Brown 108* (F), *Busey 313* (MO, NY), *Croat 4196* (NY), *Dodge et al. 16997a* (BM, F, NY), *Fendler 280* (BM, F, MO), *Folsom et al. 6846* (MO), *Fosberg R. 55630* (NY), *Garwood 2089a* (BM), *Gentry 6667* (F, NY), *Hladick 79* (MO), *Hladick 24* (MO), *Mendez 191* (F), *Shattuck 242* (F), *Standley 27572* (US), *Smith & Smith 3309* (F, MEXU, US), *Sytsma & D'Arcy 3691* (LL), *Tyson et al. 4484* (MO), *van der Werff & Herrera 6189* (MEXU, MO), *Wetmore & Abbe 14* (F), *Williams 728* (NY), *Woodworth & Vestal 309* (F), *Zetek 1-1926* (F).

6. Myriocarpa obovata Donnell Smith, Bot. Gaz. (Crawfordsville) 46: 117. 1908. TYPE: Honduras. Santa Bárbara: San Pedro Sula, 800 m, 17 Jan. 1887, *C. Thieme 5500* (holotype, US).

Myriocarpa paniculata S. F. Blake, Contr. Gray Herb. 52: 61. 1917. TYPE: Nicaragua. Granada: Volcán Mombacho, 20 Feb. 1903, *C. F. Baker 2489* (holotype, GH; isotypes, BM, CAS, DS, F, MO, US).

Habitat and distribution. *Myriocarpa obovata* is found in semi-evergreen and evergreen disturbed and undisturbed tropical moist forest, from sea level to 1400 m, and is distributed from Mexico to Costa Rica.

A few collections from Guatemala and Oaxaca (Mexico) (*Caldéron 1360* [NY], *Williams et al. 40159* [US], and *Williams et al. 40201* [BM, F, NY]) have minutely pitted adaxial leaf surfaces as opposed to the usual smooth surface. These minute pits are characteristic of *Myriocarpa heterospicata* and *M. trifurca*, but their function and homology to other structures (e.g., glands or hairs) are unknown.

Selected specimens examined. BELIZE. [s. loc.]: *Schipp 869* (BM, F, MO, NY). **Cayo:** *Cowan et al. 5155* (MEXU), *Gentle 2212* (F, LL, MEXU, NY, US), *Monro et al. 1117* (BM, MEXU), *Spellman 1376* (MO). COSTA RICA. **San José:** *Cascante 194* (CR, F), *Hammel & Morales 20610* (CR, MO), *Jimenez M. et al. 748* (BM, CR, F, MO), *Jiménez M., Q 450* (F). EL SALVADOR. **Ahuacapán:** *Chinchilla & López s.n. [ISB247]* (F), *Guerrero s.n. [ISF00211]* (LAGU, MO), *Sandoval & Sandoval 296* (F, LAGU), *Sermeno 132* (BM, LAGU), *Standley 19780* (NY). **La Libertad:** *Calderón 1514* (NY). GUATEMALA. **Petén:** *Contreras 4094* (F, LL, MEXU), *Contreras 7384* (F, LL), *Contreras 650* (F, LL), *Contreras 1927* (F, LL), *Lundell 15832* (F, LL), *Lundell 15250* (F, LL), *Lundell 2194* (F), *Lundell 15421* (F, LL, MEXU), *Molina R. 15823* (F). HONDURAS. [s. loc.]: *Record & Kuylen 9974* (NY, US), *Record & Kuylen H. 28* (US). **Colón:** *Evans 1098* (BM). **Cortés:** *Allen 6471* (F), *Molina R. 3604* (F). **Olancho:** *Blackmore & Heath 2033* (BM, MEXU), *Croat & Hannon 64131* (BM, MEXU, MO). **Santa Bárbara:** *Evans 1004* (BM), *Thieme 5500* (US). **Yoro:** *Croat & Hannon 64662* (BM, MEXU, MO). MEXICO. **Chiapas:** *Breedlove 38249* (MEXU), *Breedlove 34892* (MEXU), *Breedlove 33205* (MEXU), *Mendez T. 6107* (MEXU), *Mendez T. 5891* (BM, MEXU), *Mendez T. 4255* (BM, MEXU). **Oaxaca:** *Calderón 1360* (MEXU, NY), *Campos V. & Torres 1596* (BM), *Torres C. & Cortes A. 8842* (MEXU). **Tabasco:** *Hanan 469* (MEXU). **Veracruz:** *Dorantes 2991* (MO), *Wendt et al. 3229* (MO), *M. Vázquez T. et al. 2480A* (MO). NICARAGUA. **Chontales:** *Stevens & Krukoff 6105* (BM, MO), *Vincelli 94* (MO). **Granada:** *Baker 854* (US), *Blake 2489* (BM, CAS, DS, F, GH, MO, US), *Grijalva et al. 2889* (BM, MEXU, MO), *Moreno 6328* (BM, MO), *Moreno 6307* (BM, MO), *Moreno 6385* (BM, MO), *Moreno 6449* (BM, MO), *Moreno 15949* (BM, MO). **Madriz:** *Williams & Molina R. 20247* (F, NY). **Managua:** *Garnier 506* (US), *Garnier 1736* (US), *Grant 952* (BM, F), *Grant 1093* (US). **Masaya:** *Standley & Antonio G. 8108* (F). **Matagalpa:** *Castro 2375* (MO), *Castro 2355* (MO), *Krukoff & Stevens 11837* (BM, MO), *Moreno 25418* (BM, MO), *Moreno 23568* (MO), *Stevens et al. 21361* (MO). **Rivas:** *Moreno 19813* (BM, MO), *Moreno 19607* (MO), *Neill & Vincelli 3218* (BM, MO), *Robleto 927* (BM, MO), *Robleto 338* (BM, MO), *Robleto 147* (BM, MO), *Sandino 4149* (MO), *Sandino 4264* (MO), *Sandino 4259* (MO), *Sandino 566* (BM, MO), *Stevens & Krukoff 6592* (BM, MO). **Zelaya:** *Neill 4302* (BM, MO), *Ortiz*

1805 (BM, MO), *Pipoly 4394* (BM, MO), *Stevens & Krukoff 6880* (BM, MO).

7. Myriocarpa trifurca A. K. Monro, sp. nov. TYPE. Mexico. Veracruz: ca. 4 km al N de Xalapa, por la carretera a México, ladera exposado N del Río Sedeño, 1450 m, 1 Mar. 1981, *A. Rebolledo V. 302* (holotype, F; isotype, NY). Figure 2.

Species nova *Myriocarpae heterospicatae* Donnell Smith similis, sed ab ea lamina supra efoveata, cystolithis radialiter dispositis atque inflorescentiae staminalis ramulis minoribus differt.

Shrub or tree to 6 m, evergreen. Young shoots pubescent to densely pubescent, the hairs to 0.5 mm, appressed or weakly appressed, straight to curved, internodes 7–17 × 2.5–4 mm. Stipules 6.5–10 mm; petioles 17–62 × 1–1.5 mm, pubescent to densely pubescent, the hairs 0.25–0.75 mm; leaf blade 100–185 × 41–110 mm, elliptic, frequently asymmetrically so, membranous, subchartaceous to chartaceous; adaxial surface not minutely pitted, pubescent, the hairs 1–1.25 mm, crooked, straight, or weakly curved, the cystoliths fusiform, V-shaped fusiform, and Y-shaped fusiform, appearing flattened at their margins, arranged radially around hair bases and/or glands and perpendicular to veins; abaxial surface pubescent to densely pubescent, the hairs 0.25–0.75 mm, appressed, weakly curved or straight, cystoliths absent; principal veins 3, principal lateral veins not prominent, visible for 1/3–1/2 of the leaf length, secondary veins 3 to 5 pairs, forming a 45°–60° angle with midrib, domatia present in axils of primary and secondary veins; base cuneate, acute, or obtuse; margins serrate to base; apex cuspidate. Staminate inflorescences 42–85 mm, with 2 or 3 orders of branching, with a total flower-bearing branch length of 69–102 mm; peduncular bracts ca. 1.5 mm; peduncle densely pubescent, the hairs ca. 0.5 mm; flowers subsessile or sessile. Pistillate inflorescences 3 to 14 per stem, pendent to spreading, 45–240 × 2.5–3.25 mm, bearing 707 to 1204(5600) flowers, green or green-brown when fresh, pale brown when dry, trichotomously and/or dichotomously branched 1 or 2×, with a total flower-bearing branch length of 108–500 mm and flower density of 52 to 112 per cm; peduncular bract 1.5–9 mm; peduncle 8–30 mm, pubescent or sparsely pubescent, the hairs 0.38–0.5 mm, appressed or erect, weakly curved, crooked, or straight; flowers/fruit subsessile to sessile, pedicels when present ca. 0.13 mm. Staminate flowers ca. 0.68 × 1.75–2 mm immediately prior to anthesis; tepals immediately prior to anthesis ca. 1.5 mm; stamens not seen. Pistillate flowers/fruit 1.25–1.5 × 0.38–0.5 mm; tepals 2, 0.5–0.675 mm, weakly appressed; ovary 0.68–0.75 mm, elliptic or ovate, constricted from base for 1/4–1/3 ovary length, pubescent, the hairs 0.13–0.5 mm; style ca. 0.5 mm; stigma asymmetrical.

Habitat and distribution. *Myriocarpa trifurca* is found in pine-oak forest formations, wet forest, and riparian and secondary forest at elevations of 100–1600 m in southern Mexico (Chiapas and Veracruz).

IUCN Red List category. Conservation status for *Myriocarpa trifurca* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001), owing to the fact that the species has been collected 34 times in several localities in Chiapas and Veracruz.

Etymology. The species is named for the fact that the pistillate inflorescences are frequently trichotomously branched, a relatively uncommon branching arrangement within *Myriocarpa*.

Discussion. Collections of *Myriocarpa trifurca* are most frequently determined as *M. longipes* or *M. heterostachya* (= *M. heterospicata*). *Myriocarpa trifurca* is most similar to *M. heterospicata* because of its frequently short staminate inflorescences and elliptic leaves, and to *M. cordifolia* because of its broad pistillate inflorescence branches. The three species may be distinguished from each other as follows: (1) in *M. cordifolia*, adaxial leaf surface not minutely pitted, cystoliths radially arranged around hair bases and glands; staminate inflorescence 90–310 mm; pistillate inflorescence branches 3.5–5.5 mm diam.; pistillate flowers/fruit 1.75–2.25 mm; (2) in *M. heterospicata*, adaxial leaf surface minutely pitted, cystoliths randomly scattered; staminate inflorescence 25–170 mm; pistillate inflorescence branches 1.75–3 mm diam.; pistillate flowers/fruit 1–2 mm; and (3) in *M. trifurca*, adaxial leaf surface not minutely pitted, cystoliths radially arranged around hair bases and glands; staminate inflorescence 42–85 mm; inflorescence branches 2.5–3.3 mm diam.; pistillate flowers/fruit 1.25–1.5 mm.

Paratypes. MEXICO. **Chiapas:** Mun. Pueblo Nuevo Solistahuacán near Clinica Yerba Buena, 3 km NW of Pueblo Nuevo Solistahuacán, 1700 m, 11 July 1972, *D. E. Breedlove 26038* (LL); Mun. Ocosingo, 15 km SE of Ocosingo on rd. to San Cristóbal de Las Casas, 1372 m, 1 Sep. 1981, *D. E. Breedlove* 52593 (LL); Mun. Ocosingo, 70 km SW of Palenque on rd. to Ocosingo along the Jol Uk'um, 550 m, 4 Dec. 1980, *D. E. Breedlove & F. Almeda 48404* (LL); Mun. Mapastepec, Reserva El Triunfo poligono 1, 15°39′N, 92°48′W, 1450 m, 17 June 1990, *M. Heath & A. Long 1074* (MEXU); Mun. Pueblo Nuevo Solistahuacán, along the ridge above Pueblo Nuevo Solistahuacán, 2000 m, 15 Aug. 1967, *A. Shilom T. 2904* (LL). **Veracruz:** carretera Teocelo–Ixhuacan de los Reyes, Ixhuacan de los Reyes, 1610 m, 12 Mar. 1976, *S. Avendano R. et al. 181* (MO, NY); al lado N de Ejido La Perla de San Martín, ca. 15 km al N de Catemaco,

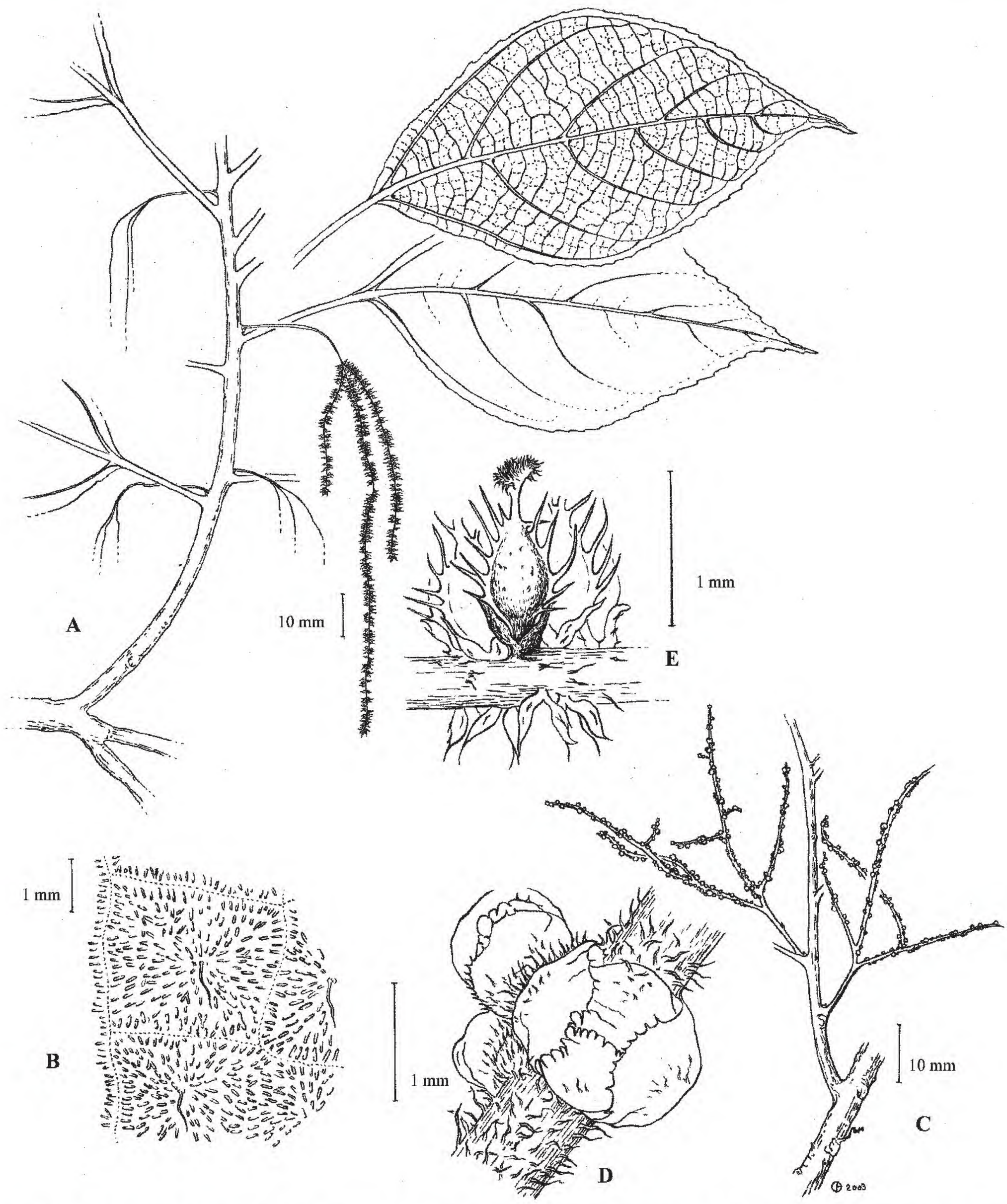

Figure 2. *Myriocarpa trifurca* A. K. Monro. —A. Habit, with pistillate inflorescences. —B. Cystolith arrangement of adaxial leaf surface. —C. Staminate inflorescence. —D. Staminate flowers immediately prior to anthesis. —E. Pistillate flowers. A–E drawn from the holotype, *A. Rebolledo V. 302* (F).

Catemaco, 18°31′N, 95°05′W, 700 m, 2 Mar. 1972, *J. H. Beaman 5826* (NY, TEX); beche de la Martinica a 2 km, Banderilla rancho del Sr. González Parra, Mun. Banderilla, 19°35′N, 96°57′W, 1480 m, 11 Nov. 1977, *G. Castillo C. et al. 124* (NY); carretera Xalapa–Naolinco, zonas cafetaleras, Jilotepec, 1400 m, 2 Mar. 1976, *C. Hernández A. et al. 54* (BM, MO); Jardín Botánico, Estación de Biología Tropical Los Tuxtlas, 18°34–36′N, 95°04–09′W, 200 m, 20 July 1983, *G. Ibarra M. 739* (MO); Estación de Biología Tropical Los Tuxtlas, 18°34–36′N, 95°04–09′W, 160 m, 15 May 1984, *G. Ibarra M. 1664* (MO); Estación de Biología Tropical Los Tuxtlas, 18°34–36′N, 95°04–09′W, 160 m, 13 Dec. 1983, *G. Ibarra M. 1123* (MO); Estación de Biología Tropical Los Tuxtlas, 18°34–36′N, 95°04–09′W, 160 m, 25 Jan. 1984, *G. Ibarra M. 1120* (MO); Estación de Biología Tropical Los Tuxtlas, 18°34–36′N, 95°04–09′W, 200 m, 3 Apr. 1984, *G. Ibarra M. 1453* (MO); Mun. Orizaba, Cerro San Cristóbal, frente a Orizaba, 1400 m, 17 Dec. 1970, *A. Lot 1105* (BM, MEXU not seen, TEX, XAL not seen); colonia militar Balzapote, San Andres Tuxtla, 100 m, 28 July 1970, *G. Martínez C. 3115* (MO); gorge of Río Metlac, just downstream and beneath the bridges of the Córdoba–Orizaba hwy., 150 m

above Cuota México, 1 km (by air) W of Fortín, Mun. Iztaczoquiatlán, 18°54′N, 97°00′30″W, 900 m, 7 Feb. 1984, *M. Nee & K. Taylor 29414* (BM, MO, NY); along very winding rd. from Naolinco to Misantla, 13 km by rd. S of turnoff to Yecuatla and 6 km by rd. N of Paz de Enríquez, Mun. Yecuatla, 19°51′N, 96°48′30″W, 1200 m, 2 Apr. 1983, *M. Nee et al. 26354* (NY); 2 km al NE de Iztapan, camino a Dos Pozitos, Tonayan, 1200 m, 28 Nov. 1975, *R. Ortega et al. 32* (MO); ravines near Orizaba, 4000 ft., 18 Jan. 1895, *C. G. Pringle 6093 M* (BM, US); Zacuapan, Jan. 1905, *C. A. Purpus 2964* (BM, US); on rocks, barranca near La Palmilla, 1934, *C. A. Purpus 16265* (F, US); el brincadero, cerca de un arroyo que atraviesa el camino de Jilotepec a Naolinco, 28 Dec. 1975, *C. H. Ramos 354* (US); ca. 4 km al N de Xalapa por la carretera a México, ladera exposición N del Río Sedeño, 1450 m, 1 Mar. 1981, *A. Rebolledo V. 302* (MO, NY); Apatlanco 2 km N de Santa Ana Atzacan, 1300 m, 4 Jan. 1967, *M. Rosas R. & R. Hernandéz 130* (BM); Cerro de Escamela al N de Orizaba, 1450 m, 17 Jan. 1968, *M. Rosas R. 989* (BM); Cerro de Chicahuaxtla–Cuauhtlapan, 1600 m, 22 Jan. 1968, *M. Rosas R. 1041* (BM); Cerro de San Cristóbal, 5 km al SW de Orizaba, 1300–1600 m, 15 Dec. 1959, *J. Rzedowski 12171* (MO); Cerro Lázaro Cárdenas lote 71, Estación de Biología Tropical Los Tuxtlas, 18°34–36′N, 95°04–09′W, 600 m, 9 Aug. 1985, *S. Sinaca C. 186* (MO); limites con Omelca, Mun. Coetzala, 600 m, 16 July 1976, *V. Vázquez T. 469* (NY); Tonacalco, Zongolica, 1150 m, 4 Mar. 1976, *C. Velázquez L. 22* (MO); Mun. Teocelo, La Barranca, 1000 m, 22 Feb. 1979, *F. Ventura A. 15799* (TEX); Mun. Teocelo, Barranca de Teocelo, 1020 m, 23 Dec. 1975, *M. G. Zola B. 116* (NY).

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Nitidobulbon, a New Genus of Maxillariinae (Orchidaceae)

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Abstract. *Nitidobulbon* Ojeda, Carnevali & G. A. Romero, a new genus of the Maxillariinae (Orchidaceae), is described and illustrated. Its circumscription is supported by morphological, anatomical, and molecular evidence. The three species of *Nitidobulbon* are characterized by long flower peduncles, smooth, shiny pseudobulbs, and distinctive leaf anatomy. We present a taxonomic key to differentiate *Nitidobulbon* from related genera and also provide a key to the species within the genus. Three new combinations are established: *N. cymbidioides* (Dodson, J. T. Atwood & Carnevali) Ojeda & G. A. Romero, *N. nasutum* (Reichenbach f.) Ojeda & Carnevali, and *N. proboscideum* (Reichenbach f.) Ojeda & Carnevali. In synonymy to *N. nasutum*, the name *Maxillaria oxysepala* Schlechter is lectotypified.

Resumen. *Nitidobulbon* Ojeda, Carnevali & G. A. Romero, un nuevo género de Maxillariinae (Orchidaceae), es descrito e ilustrado. Su circunscripción se apoyada en evidencia morfológica, anatómica y molecular. Las tres especies de *Nitidobulbon* se caracterizan por largos pedúnculos florales, seudobulbos lisos y brillantes, y por una anatomía foliar distintiva. También presentamos una clave para diferenciar *Nitidobulbon* de géneros emparentados, otra para las especies del genero y proponemos tres nuevas combinaciones: *N. cymbidioides* (Dodson, J. T. Atwood & Carnevali) Ojeda & G. A. Romero, *N. nasutum* (Reichenbach f.) Ojeda & Carnevali y *N. proboscideum* (Reichenbach f.) Ojeda & Carnevali. En la sinonimia a *N. nasutum*, el nombre *Maxillaria oxysepala* Schlechter es lectotipificado.

Key words: Heterotaxis, *Maxillaria*, Maxillariinae, *Nitidobulbon*, Orchidaceae, *Ornithidium*.

As currently circumscribed, Maxillariinae (Orchidaceae) consists of two groups of genera. The first group is the complex of genera around *Lycaste* Lindley and *Bifrenaria* Lindley, which is composed of genera basal in the phylogenetic tree of the subtribe that feature (1) plicate or subcoriaceous leaves always with convolute vernation (Romero & Carnevali, 2001) and (2) racemose or 1-flowered inflorescences. The phylogenetic relationships within the *Lycaste* alliance (sensu Dressler, 1993) were studied by Ryan et al. (2000), while the relationships within the *Bifrenaria* alliance were analyzed by Koehler et al. (2002). Further into the phylogenetic tree, there is another large, internal clade (ca. 650 spp., Govaerts et al., 2005) corresponding to Maxillariinae sensu Dressler (1993). This clade is characterized by 1-flowered inflorescences and conduplicate leaves, and will hereafter be referred to as the Core Maxillariinae (sensu Whitten et al., 2007).

Past classification systems (Dressler, 1993) and floristic treatments (e.g., Atwood & Mora Retana, 1999; Carnevali & Ramírez, 2003) have traditionally recognized eight genera within Core Maxillariinae, although often admitting that generic boundaries were unsatisfactory, probably unnatural, and required phylogenetic research. These eight genera are *Anthosiphon* Schlechter, *Chrysocycnis* Linden & Reichenbach f., *Cryptocentrum* Bentham, *Cyrtidiorchis* Rauschert, *Maxillaria* Ruiz & Pavón, *Mormolyca* Fenzl, *Pityphyllum* Schlechter, and *Trigonidium* Lindley.

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Among these eight genera, *Maxillaria* has always been the largest, containing most of the species of the subtribe, while the remaining seven genera were defined by several floral apomorphies. A recent phylogenetic work using several DNA regions, both nuclear and plastid (Whitten et al., 2007), identifies 17 clades within Core Maxillariinae, which are deemed worthy of generic recognition due to morphological and geographical coherence and distinctness, as well as high bootstrap support. A first striking conclusion from the phylogenetic topologies recovered from this phylogenetic analysis is the fact that, as previously circumscribed, *Maxillaria* is grossly polyphyletic with all of the other genera traditionally recognized as embedded within it. A second conclusion is that generic concepts of past taxonomy had overemphasized homoplasious floral characters, leaving the genus *Maxillaria* as a catch-all taxonomic recipient for members of Core Maxillariinae lacking these floral apomorphies. It is obvious from this recent phylogeny that vegetative morphology and geography were as good (or better) predictors of relationships as floral morphology.

The phylogenetic structure revealed by Whitten et al. (2007) is reflected in a classification system proposed by Blanco et al. (2007). One of the clades, located in a basal position within Core Maxillariinae, will be referred to as the *Heterotaxis* clade and consists of three internal subclades. The *Heterotaxis* clade received 100% bootstrap support in the combined nuclear ribosomal ITS (nrITS), *matK* + *trnK*, and *atpB-rbcL* spacer analysis in Whitten et al. (2007). A five-region analysis performed by these same authors for a smaller sample of taxa using the plastid *rpoC1* region yielded a similar topology and level of support for the *Heterotaxis* clade (Whitten et al., 2007). The three internal subclades are less well supported (see below) but are morphologically distinctive. These subclades were earlier recovered in the morphology + anatomy + nrITS analyses by Ojeda (2003) and Ojeda et al. (2003). An alternative classification system would treat these three subclades as a single genus, but such a taxonomic aggregation would be morphologically undiagnosable. Because there are already generic names for two of these subclades, including the proper combinations for many of the species, we have chosen to treat the three subclades as different taxa at the generic level. These three clades are *Heterotaxis* Lindley (71% bootstrap support in the four-region analysis; 74% in the five-region analysis), *Ornithidium* Salisbury ex R. Brown (60% and 77% support, respectively), and the complex of species around *Maxillaria nasuta* Reichenbach f. (81% and 79% support, respectively) (Whitten et al., 2007: 1862). This last species group lacks a generic name and is herein proposed as such, as the new genus, *Nitidobulbon*. In the combined molecular analysis (Whitten et al., 2007), the relationships of the three clades are unresolved. However, in the combined morphology + anatomy + nrITS analysis (Ojeda, 2003: 67), *Nitidobulbon* is sister to *Heterotaxis* + *Ornithidium*, clades receiving 97% and 100% jackknife support, respectively. Thus, we feel confident that the hypothesis of relationships here proposed will be supported by further phylogenetic analyses. Furthermore, the fact that the three clades are morphologically distinct and easily diagnosable, both florally and vegetatively, warrants and supports the recognition of three distinct genera.

Heterotaxis comprises 11 orchid species of mainly sympodial growth, which are characterized by short rhizomes and laterally compressed, oblong, unifoliate pseudobulbs subtended by various leaf-bearing sheaths. The flowers are yellow to orange, although the labellum can rarely be purple and the calli vary in size and texture (Carnevali, 1991).

Within *Heterotaxis*, two major clades have been recovered (Ojeda, 2003), with one clustered around *H. sessilis* (Swartz) F. Barros (i.e., the Sessilis clade) and a second clustered around *H. discolor* (G. Loddiges ex Lindley) Ojeda & Carnevali (i.e., the Discolor clade). The Sessilis clade comprises species with small vegetative and floral parts, with pseudobulbs mostly hidden by the leaf sheaths, and the leaves succulent and typically deeply concave to triquetrous (Ojeda, 2003). In contrast, the Discolor clade contains robust, taller species exceeding 40 cm with large vegetative and floral parts, pseudobulbs that are well exposed, and leaves that are flat and coriaceous (Ojeda, 2003).

The *Maxillaria nasuta* clade, which includes *M. cymbidioides* Dodson, J. T. Atwood & Carnevali and *M. proboscidea* Reichenbach f. (Ojeda, 2003; Ojeda et al., 2005), has previously been included in the *Heterotaxis* alliance (Carnevali, 1991; Barros, 2002; Christenson, 2002). The three species in this clade are commonly misidentified and confused with those of the Discolor clade of *Heterotaxis*, especially when working with sterile specimens. However, current evidence from morphology and gross foliar anatomy can identify six synapomorphies in *M. nasuta* and relatives (see the key below): (1) bracts are large, wrapping the internodes of the peduncle, largely obscuring the peduncular axis; (2) the inflorescence peduncle is longer than the pseudobulb; (3) the floral bract covers the pedicel and part of the ovary; (4) the surface of the column is papillose; (5) the dorsal (adaxial) surface of the petals is papillose; and (6) the leaves exhibit a type IV vascular pattern, with three sizes of vascular bundles (large, usually occupying the

entire mesophyll from adaxial to abaxial epidermis; medium; and small, with medium and small bundles alternating several times between two larger vascular bundles) (Ojeda, 2003). We decided to include *M. nasuta*, *M. cymbidioides*, and *M. proboscidea* in a new genus rather than lumping *Heterotaxis*, *Ornithidium*, and the *M. nasuta* clade (where *Ornithidium* has nomenclatural priority). In our opinion, such a broad circumscription of *Ornithidium* would be morphologically too heterogeneous and therefore recognizable only on the basis of molecular evidence.

Nitidobulbon Ojeda, Carnevali & G. A. Romero, gen. nov. TYPE: *Nitidobulbon nasutum* (Reichenbach f.) Ojeda & Carnevali.

Hoc genus *Heterotaxidi* Lindley affinis, sed ab ea bracteis floralibus ovarium excedentibus atque pseudobulbis nitidis valde compressis recedit.

Plants caespitose epiphytes, more rarely lithophytes or subterrestrials, erect, ca. 20–40 cm tall; rhizomes with reduced internodes; pseudobulbs large, 6–9 cm tall × 3–5 cm wide, laterally compressed, without ridges, smooth, appearing varnished; generally unifoliate, rarely bifoliate. Leaves coriaceous, erect on the pseudobulb apex, basally attenuate and forming a 2–4 cm pseudopetiole, apex bilobed; 3 sizes of vascular bundles in a medial cross section of the leaves: (1) large (usually occupying the entire mesophyll from adaxial to abaxial epidermis), (2) medium, and (3) small, arranged as type IV (Ojeda, 2003). Inflorescence 1-flowered, borne on axils of pseudobulb-subtending leaves; peduncle fleshy, 12–14 cm, ca. twice as long as the pseudobulb, with 4 internodes, generally the 2 closest to the ovary shorter than the 2 distant from the ovary; covered by triangular bracts usually as long as the internodes; floral bract similar to peduncular bracts, membranous, triangular, acute, ca. 2 cm, similar in length to ovary. Flowers relatively large, 3–5 cm wide, resupinate, yellow to brown; lateral sepals similar to the dorsal sepal, oblanceolate to spatulate, acute, yellow to brown, externally papillose; petals ± similar to sepals, but shorter and narrower; labellum articulate to column foot, usually red to brown, surface shiny, lacking a raised pad of glandular hairs (as in *Heterotaxis*); pollinia 4, unequal, on a squarish to oblong tegula; column 8–10 mm, hemicylindric, papillose, arcuate and with a poorly defined foot. Fruit a capsule with lateral dehiscence.

Etymology. The new genus name is taken from the Latin "nitidus," meaning shiny, and "bulbus," meaning bulb, in reference to the shiny, varnished texture of the pseudobulbs.

KEY TO THE GENERA *NITIDOBULBON*, *HETEROTAXIS*, AND *ORNITHIDIUM*

1a. Caespitose, sympodial, or pseudomonopodial plants; internodes reduced, with a single 1-flowered inflorescence per leaf axil; column arcuate; labellum free, mostly flat to concave; fruits laterally dehiscent. 2

1b. Caespitose, pseudomonopodial, or monopodial plants; internodes reduced to elongated, with 1 to many 1-flowered, simultaneous inflorescences per leaf axil; column sigmoid; labellum basally adnate to the column or free (if so, then ≤ 10 mm long, variously lobed, recurved to sigmoid, often ciliate or fimbriate), often saccate; fruits apically dehiscent . . . . . *Ornithidium*

2a. Floral peduncle almost always as long or longer than pseudobulb; pseudobulbs laterally compressed, without ridges and with a shiny varnished surface; petals without a subapical mucron; leaf cross section with 3 sizes of vascular bundles, the largest spanning the entire mesophyll. . . .*Nitidobulbon*

2b. Floral peduncle shorter than to equal in length to pseudobulbs; pseudobulbs (when present) laterally compressed, with longitudinal ridges and without shiny varnished surface; petals with a subapical mucron; leaf cross section with 2 sizes of vascular bundles, the largest not spanning the entire mesophyll . . . . . *Heterotaxis*

KEY TO THE SPECIES OF *NITIDOBULBON*

1a. Plants relatively small, pseudobulbs 4.5–5.5 cm long; leaves 20–24 mm wide; sepals 25–27 mm long; labellum 14–15 mm long . . . . . *N. cymbidioides*

1b. Plants relatively large, pseudobulbs 8–12 cm long; leaves 25–50 mm wide; sepals 27–35 mm long; labellum 18–25 mm long 2

2a. Sepals widely spreading, apices obtuse or acute; labellum apically broadly obtuse to rounded, bracts of the inflorescence not inflated; floral bract shorter than the pedicellate ovary . . . . . *N. proboscideum*

2b. Sepals either ± parallel to the petals or reflexed, apices acuminate; labellum ± acuminate or acute; bracts of the inflorescence usually ± inflated; floral bract longer than or nearly equal to the pedicellate ovary. . . . . *N. nasutum*

1. **Nitidobulbon cymbidioides** (Dodson, J. T. Atwood & Carnevali) Ojeda & G. A. Romero, comb. nov. Basionym: *Maxillaria cymbidioides* Dodson, J. T. Atwood & Carnevali, Orquideología 20: 266. 1997. TYPE: Ecuador. Imbabura: Lita to Ibarra, Km 11; terrestrial on embankment, 700 m, 27 Mar. 1994 [specimen in flower prepared 10 Nov. 1994], *C. H. Dodson & G. Carnevali 19270* (holotype, MO).

Distribution. *Nitidobulbon cymbidioides* is currently known with certainty only from the western slopes of the Andes in northern Ecuador, although it may also occur in neighboring southwestern Colombia (Nariño Department).

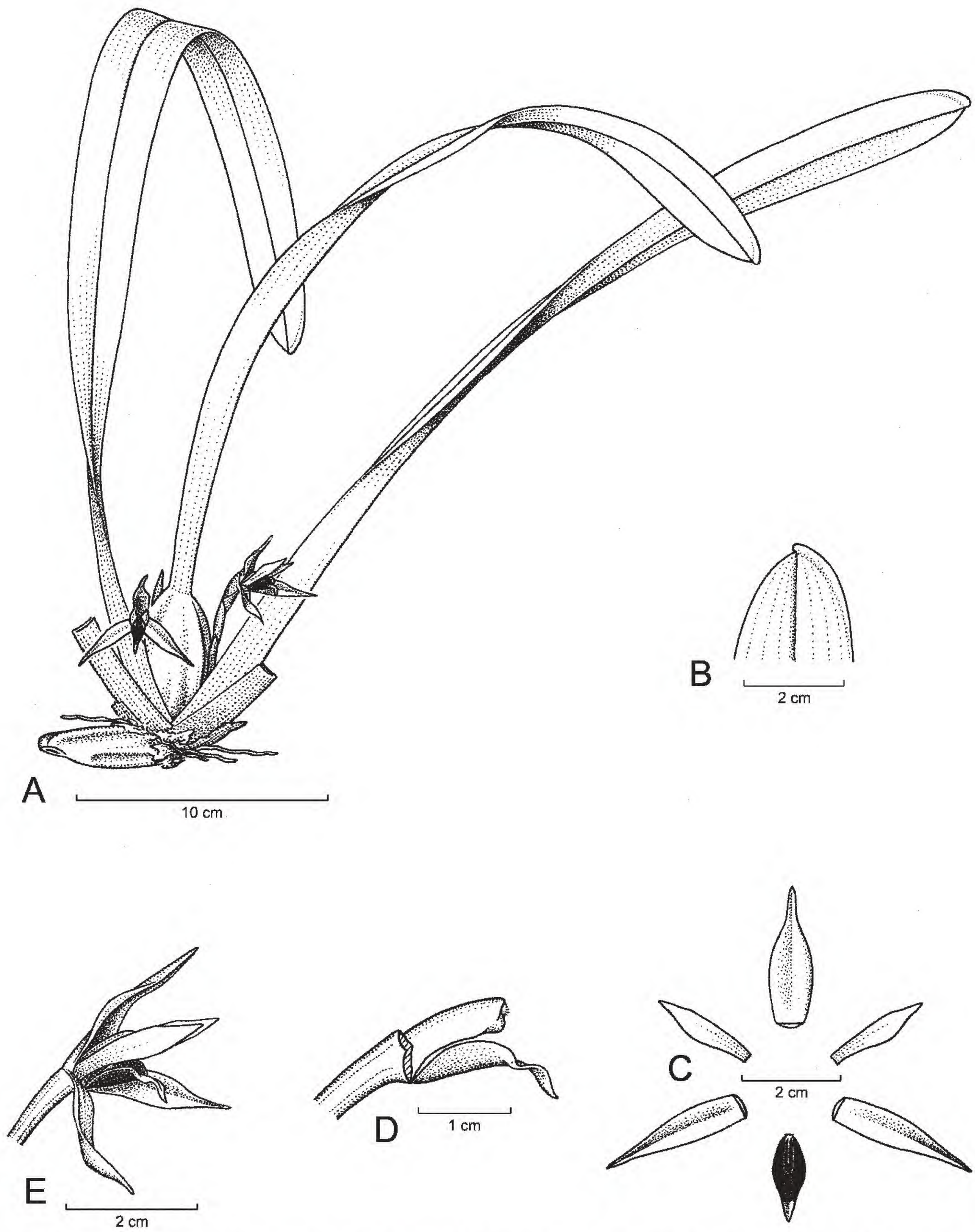

Figure 1. *Nitidobulbon nasutum* (Reichenbach f.) Ojeda & Carnevali. —A. Flowering plant. —B. Apex of leaf. —C. Floral segments. —D. Lateral view of column and lip (sepals and petals removed). —E. Lateral view of flower. Based on *G. C. K. & E. Dunsterville 298* (AMES), from Venezuela.

2. Nitidobulbon nasutum (Reichenbach f.) Ojeda & Carnevali, comb. nov. Basionym: *Maxillaria nasuta* Reichenbach f., Beitr. Orchid.-K. C. Amer. 104. 1866. TYPE: Novo Granada [Colombia]. Lajitas, s.d., *L. J. Schlim 9* (holotype, W [Reich. Hb. Orchid. 47880]; isotype, K). Figure 1.

Maxillaria nasalis Reichenbach f., Ref. Bot. 2: t. 102. 1872, nom. illeg. TYPE: Costa Rica, s.d., *A. R. Endress 266* (holotype, W).

Maxillaria glumacea Rolfe, Bull. Misc. Inform. Kew 210. 1892. Syn. nov. TYPE: Brazil. s.d., *Hort. Sander s.n.* (holotype, K).

Maxillaria brevipedunculata Ames & C. Schweinfurth, Sched. Orchid. 10: 91. 1930. TYPE: Costa Rica. Toro

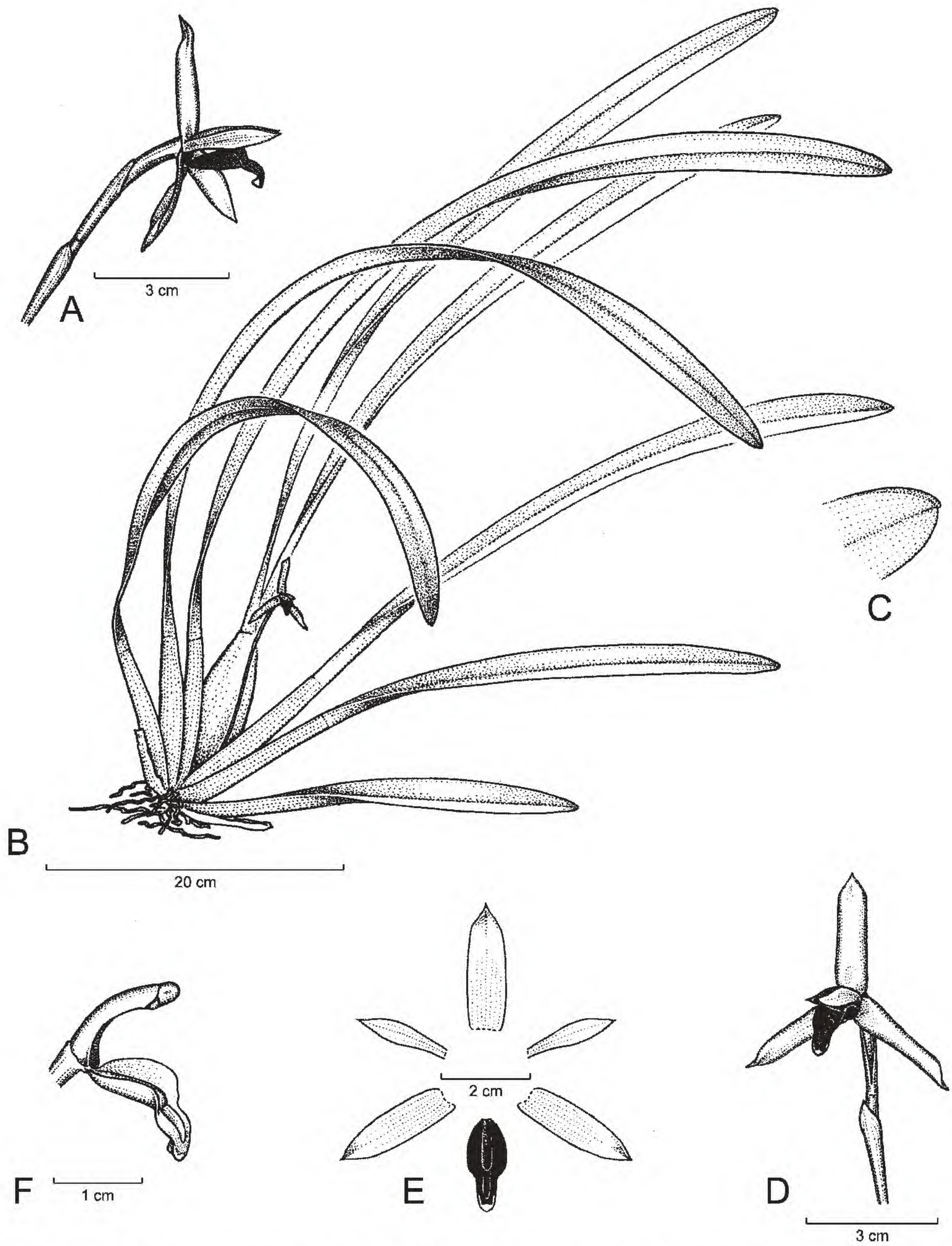

Figure 2. *Nitidobulbon proboscideum* (Reichenbach f.) Ojeda & Carnevali. —A. Back view of flower. —B. Flowering plant. —C. Apex of leaf. —D. Front view of flower. —E. Floral segments. —F. Side view of column and lip (sepals and petals removed). Based on *G. C. K. & E. Dunsterville 379* (AMES), from Venezuela.

Amarillo, 1600 m, 19 Sep. 1925, *A. Alfaro 190* (holotype, US).

Maxillaria oxysepala Schlechter, Repert. Spec. Nov. Regni Veg. 27: 73. 1929. TYPE: Bolivia. La Paz: Hacienda Simaco sobre el camino a Tipuani, 1400 m, Feb. 1920, *O. Buchtien 5003* (lectotype, designated here, AMES 25122; isotypes, AMES 26478, G, US).

Distribution. As currently circumscribed, *Nitidobulbon nasutum* ranges from southern Mexico, throughout Central America, and into Bolivia along the Andean Range, the Venezuelan Coastal Range, the Guianas, and the northern Amazon Basin.

Discussion. The holotype of *Maxillaria oxysepala*, originally at B, was destroyed. We have selected AMES 25122 as lectotype because it is the most representative specimen we examined.

3. Nitidobulbon proboscideum (Reichenbach f.) Ojeda & Carnevali, comb. nov. Basionym: *Maxillaria proboscidea* Reichenbach f., Bonplandia 2: 16. 1854. *Heterotaxis proboscidea* (Reichenbach f.) F. Barros, Hoehnea 29: 113. 2002. TYPE: Venezuela. Dist. Capital: Caracas, s.d., *H. Wagener s.n.* (holotype, W [Reich. Hb. Orchid. 47879]). Figure 2.

Distribution. *Nitidobulbon proboscideum* is likely restricted to northern Venezuela, possibly into the Guayana Region (Carnevali & Ramírez, 2003). Plants from outside this area that are referred to this species in floristic treatments may belong to *N. nasutum* or to other, possibly undescribed taxa.

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Stonesia ghoguei, Peculiar Morphology of a New Cameroonian Species (Podostemaceae, Podostemoideae)

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Abstract. The traditional circumscription of the genus *Stonesia* G. Taylor (Podostemaceae, Podostemoideae) includes three species restricted to western tropical Africa. Here, a new species, *S. ghoguei* E. Pfeifer & Rutishauser, is described, which represents the first Cameroonian member of the genus. There are another three *Stonesia* species restricted to western tropical Africa (Guinea and Sierra Leone). The genus *Stonesia* is characterized by capsule valves with five or seven ribs each, with the ribs nearest the sutures shorter and not reaching the ends of valves. This unique pattern is shared with the two Madagascan genera *Endocaulos* C. Cusset and *Paleodicraeia* C. Cusset. Molecular (*matK*) data indicate that this capsule pattern is homoplastic, occurring in Madagascar and (with *Stonesia*) in tropical Africa. Various characters of *Stonesia* (including *S. ghoguei*) are also found in other African podostemoids. These include flower buds inverted in the sac-like spathella; crustose roots or broad ribbons with exogenous root lobes (daughter roots); stems usually simple (rarely branched), up to 10(–40) cm long; flowers arising primarily from endogenous buds inside the stem cortex in *S. ghoguei* and *S. fascicularis* G. Taylor; and leaves repeatedly forked into narrow segments, with epiphyllous flowers arising from the clefts of these forks in *S. ghoguei* and *S. heterospathella* G. Taylor. Unlike the western African *Stonesia* species, *S. ghoguei* has pollen mainly released in monads (not only dyads), one stamen per flower with two lateral tepals (not two stamens with three tepals), and unilocular ovaries (not bilocular ones).

Key words: Cameroon, cauliflory, endogenous floral buds, epiphyllous flowers, IUCN Red List, *Ledermanniella*, Podostemaceae, *Stonesia*, structural diversity.

The Podostemaceae (river weeds) are mainly restricted to tropical rivers, waterfalls, and cataracts in regions with distinct seasonality, where they grow attached to rocks or other solid substrata without penetrating them. The vegetative plants are completely submerged in swiftly running water during the rainy season. Emergent flowers and fruits are formed when the water recedes during the dry season. The Podostemaceae are the largest group of strictly aquatic flowering plants (Cook, 1999). Most of the ca. 280 species and many of the 49 genera are endemic to small geographical areas such as a single river or a country (Ameka et al., 2003; Cook & Rutishauser, 2007). They show three main centers of biodiversity: Latin America, tropical Africa, and South to Southeast Asia (Engler, 1928; Cusset, 1987; Kato, 2006). There are 16 genera and ca. 85 species known from Africa and Madagascar; except for *Tristicha* Thouars, all of them are endemic to Africa and/or Madagascar. Eight of the 15 endemic genera occur with just one species in Africa or Madagascar. Most genera, including *Stonesia*, consist of six or fewer species. *Ledermanniella* Engler (as defined by Cusset, 1974, 1983, 1984) is the only species-rich exception in Africa, containing ca. 46 species. This genus, however, seems to be artificial, because—based on molecular and morphological evidence—various small African genera of Podostemoideae are nested in it. According to Moline et al. (2007), all podostemoids studied from Continental Africa form a clade that is sister to the Madagascan genera *Endocaulos* C. Cusset and *Thelethylax* C.

Cusset. The reader will find identification keys, drawings, and short descriptions of all African and Madagascan taxa on the website: <http://www.systbot.uzh.ch/podostemaceae> (Rutishauser et al., 2007).

Stonesia as a new podostemoid genus was described by Taylor (1953). There have been three *Stonesia* species described; these are confined to a small region in Guinea and Sierra Leone, western tropical Africa (Cusset, 1973; Lebrun & Stork, 1991; Cook & Rutishauser, 2007). The genus *Stonesia* as known until now was distinguishable by the combination of three unique characters: (1) the number of capsule ribs varies from 12 to 18 (i.e., there are five to seven ribs per valve plus the sutures, usually marked by twin ribs that disappear after dehiscence); (2) the ribs nearest to the sutures do not run the whole capsule length but begin on the suture above the base and, curving parallel to the other ribs, rejoin it below the apex; and (3) flowers show two stamens on a common foot (andropodium) and three subulate tepals, one tepal on each side of the andropodium, and the third tepal in the fork between the filaments.

We studied recently collected accessions from Cameroon, which represent a new species attributed to *Stonesia*.

Materials and Methods

The plant specimens used in the present study were fixed and preserved in 70% ethyl alcohol. The wet plant material is deposited in the National Herbarium of Cameroon (YA) and the Herbarium of Zurich Universities (Z/ZT). For scanning electron microscopy, the dissected plant parts were critical point dried and sputter-coated with gold. The electron micrographs were taken with a JEOL scanning electron microscope (JEOL, Ltd., Tokyo) at 20 kV. For microtome sections, specimens were embedded in Kulzer's Technovit 7100 (2-hydroethyl methacrylate; Heraeus Kulzer GmbH, Wehrheim, Germany) and sectioned with a MICROM HM 355 rotary microtome (GMI, Inc., Ramsey, Minnesota, U.S.A.) and conventional microtome knife types C and D. The mostly 7 μm thick sections were stained with ruthenium red and toluidine blue.

To test possible relationships of *Stonesia ghoguei* to African and non-African taxa, we conducted a phylogenetic analysis based on *matK* sequence data. A modified data set by Moline et al. (2007) (tree base M2581) was used. Of these taxa, *Cladopus japonicus* Imamura (selected outgroup = OG), *Dicraeanthus africanus* Engler, *Djinga felicis* C. Cusset (accessions 1 and 2), *Endocaulos mangorense* (Perrier) C. Cusset, *Hydrobryum japonicum* Imamura (OG), *Ledermanniella bifurcata* (Engler) C. Cusset, *L.* cf. *bosii* C. Cusset, *L. bowlingii* (J. B. Hall) C. Cusset, *L. ledermannii* (Engler) C. Cusset (accessions 1 and 2), *L. letouzeyi* C. Cusset, *L. linearifolia* Engler, *Podostemum ceratophyllum* Michaux (OG), *Polypleurum stylosum* (Wight) J. B. Hall (OG), *Thelethylax minutiflora* (Tulasne) C. Cusset, and *Zeylanidium olivaceum* Engler (OG) were included, and *S. ghoguei* (from the type *Ghogue* GHO 1665; GenBank Acc. No. AM937251) was added. A maximum likelihood (ML, Felsenstein, 1981) analysis was performed using PAUP 4.0 (Swofford, 1998). To determine the nucleotide substitution model that best fits the data, the hierarchical likelihood ratio test was used in Modeltest 3.0 (Posada & Crandall, 1998). ML analyses specifying the TVM + G model were implemented as heuristic searches with a 100 random-addition-sequence, tree bisection-reconnection, and steepest descent options. The same options were used for ML bootstrap analyses (100 replicates).

Results

Stonesia ghoguei E. Pfeifer & Rutishauser, sp. nov. TYPE: Cameroon. Adamawa: Ngaoundéré, Tello Waterfalls, 1100 m, 07°14′00″N, 13°57′00′E, 16 Feb. 2005, *J.-P. Ghogue* GHO 1665 (holotype, YA; isotypes, K, Z). Figures 1–5, 6A–G, I–M.

Haec species a congeneris tepalis lateralibus duobus, stamine in quoque flore solitario, ovario uniloculari atque polline plerumque in monadis liberato distinguitur.

Caulescent herb, attached to rocks; *roots* (thallus) dorsiventrally flattened, ribbon-like, more rarely crustose, root cap lacking, root with exogenous daughter roots or lobes; vegetative stems and reproductive short shoots arising from endogenous buds inside root, arranged along root margin, or in cleft of lobed root; *vegetative stems* to 10 cm, simple, giving rise to leaves on one side (due to dorsiventral distichy). *Foliage leaves* with repeatedly forked segments, to 8.5 cm, distal segments linear, slightly flattened and when young provided with hairs on one side. *Bracts* below or between flowers of reproductive short shoots 1 or 2, entire or bifid, usually inconspicuous; *spathellas* (sac-like covers) around each floral bud are ovoid, with papillate surface; *flowers* along root margin, or sessile on upper root surface; flowers also along stems, arising from endogenous buds inside stem cortex; additional flowers on leaves (epiphyllous), arising from clefts of leaf forks; flower bud inside spathella completely inverted; flower in anthesis 1–1.5 mm; with pedicel ca. 2 mm, curved at apex, at last erect, elongating to 4 mm; tepals 2 and stamen 1; *pollen* released in monads, rarely dyads; *ovary* unilocular, lacking

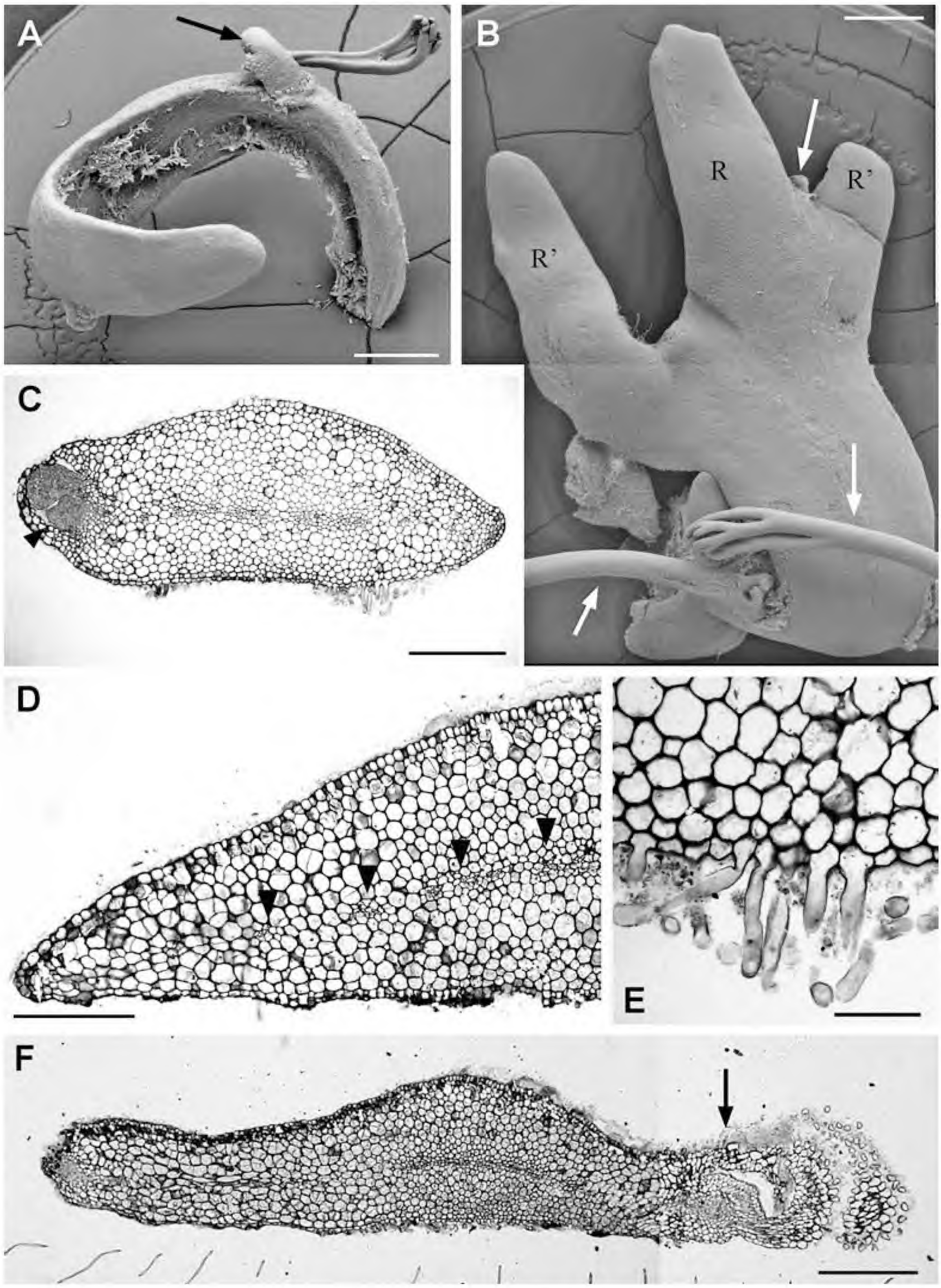

Figure 1. *Stonesia ghoguei* (from the type *Ghogue* GHO 1665). Roots and root-borne shoot buds. —A. Ribbon-like root twisted around stem base (see Fig. 6K). Arrow points to foliage leaf arising from endogenous site along root margin. Note adhesive hairs on flat lower root surface. Scale bar = 1 mm. —B. Distal portion of flattened root (R) becoming crustose due to the outgrowth of exogenous lateral lobes (R′). Arrows point to foliage leaves arising from endogenous sites along root margin. Scale bar = 1 mm. —C. Cross section of ribbon-like root with young endogenous shoot bud (arrowhead). Note inconspicuous layer of vascular tissue inside root and adhesive hairs along lower surface. Scale bar = 500 μm. —D. Cross section (left half) of another ribbon-like root. Arrowheads point to layer of vascular tissue. Scale bar = 250 μm. —E. Close-up of lower (ventral) root side with adhesive hairs. Scale bar = 100 μm. —F. Cross section of flattened crustose root. Arrow points to reproductive short shoot arising from root margin. Scale bar = 500 μm.

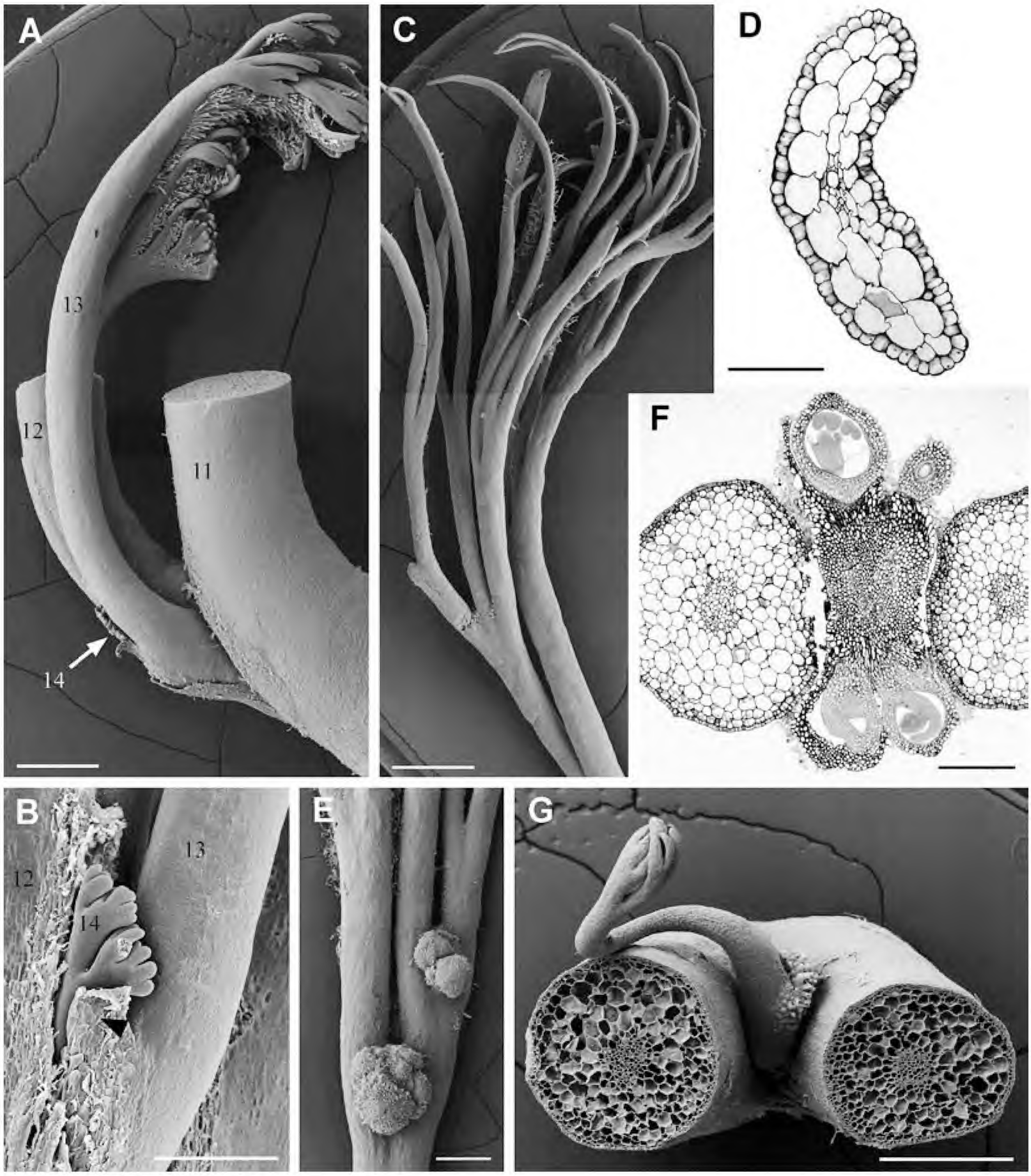

Figure 2. *Stonesia ghoguei* (from the type *Ghogue* GHO 1665). Leafy stems, compound leaves, and epiphyllous shoots. —A. Growing tip of vegetative shoot (as drawn in Fig. 6C, E), with two nearly mature leaves (11, 12) removed except for their petiole bases. Outgrowing leaf 13 with forked blade. Note hairs covering lower side of distal blade segments. Outgrowing young leaf 14 is observable on backside between 12 and 13. Scale bar = 1 mm. —B. Close-up of young leaf 14 arising from pocket between 12 and 13. Arrowhead points to lateral stipule attached to leaf 13. Scale bar = 500 μm. —C. Distal portion of nearly mature compound blade. Few hairs along lower surface of distal leaf segments still present. Scale bar = 1 mm. —D. Cross section of distal leaf segment (flattened, with indistinct vascular bundle). Scale bar = 100 μm. —E. Proximal portion of compound blade, with two forks occupied by epiphyllous flower clusters. Scale bar = 1 mm. —F. Cross section of proximal blade fork, its cleft occupied by an epiphyllous short shoot with four flower buds, surrounded by a spathella each. Scale bar = 500 μm. —G. SEM graph of another proximal blade fork, with epiphyllous leaf arising from cleft. Scale bar = 1 mm.

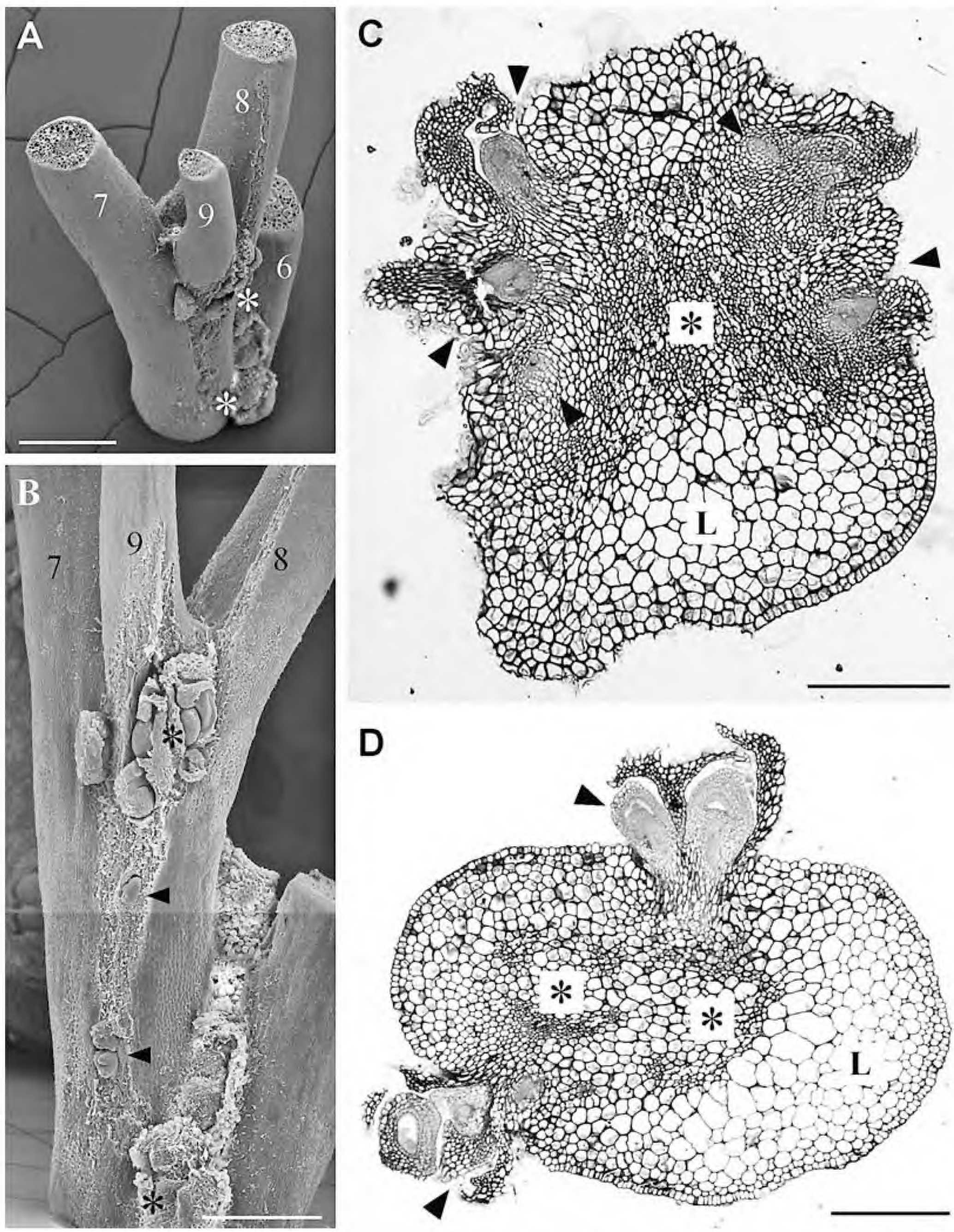

Figure 3. *Stonesia ghoguei* (from the type *Ghogue* GHO 1665). Mature stems with endogenous initiation of floral buds. —A, B. Two views of distal portion of 4.5 cm long stem (as drawn in Fig. 6L, M). Stem cortex ruptured due to endogenous formation of reproductive short shoots (asterisks). Arrowheads point to additional endogenous floral buds in between. Scale bars: A = 1 mm; B = 500 μm. —C. Cross section of mature stem. L = stem sector exactly below insertion area of a foliage leaf, consisting of large parenchyma cells. Arrowheads point to sites in stem cortex with endogenous formation of floral buds. Note presence of scattered vascular tissue (asterisk) in stem center. Scale bar = 500 μm. —D. Cross section of another stem portion. Arrowheads point to floral buds with scale-like bracts rupturing the stem cortex. Asterisks indicate vascular tissue in stem center. Scale bar = 500 μm.

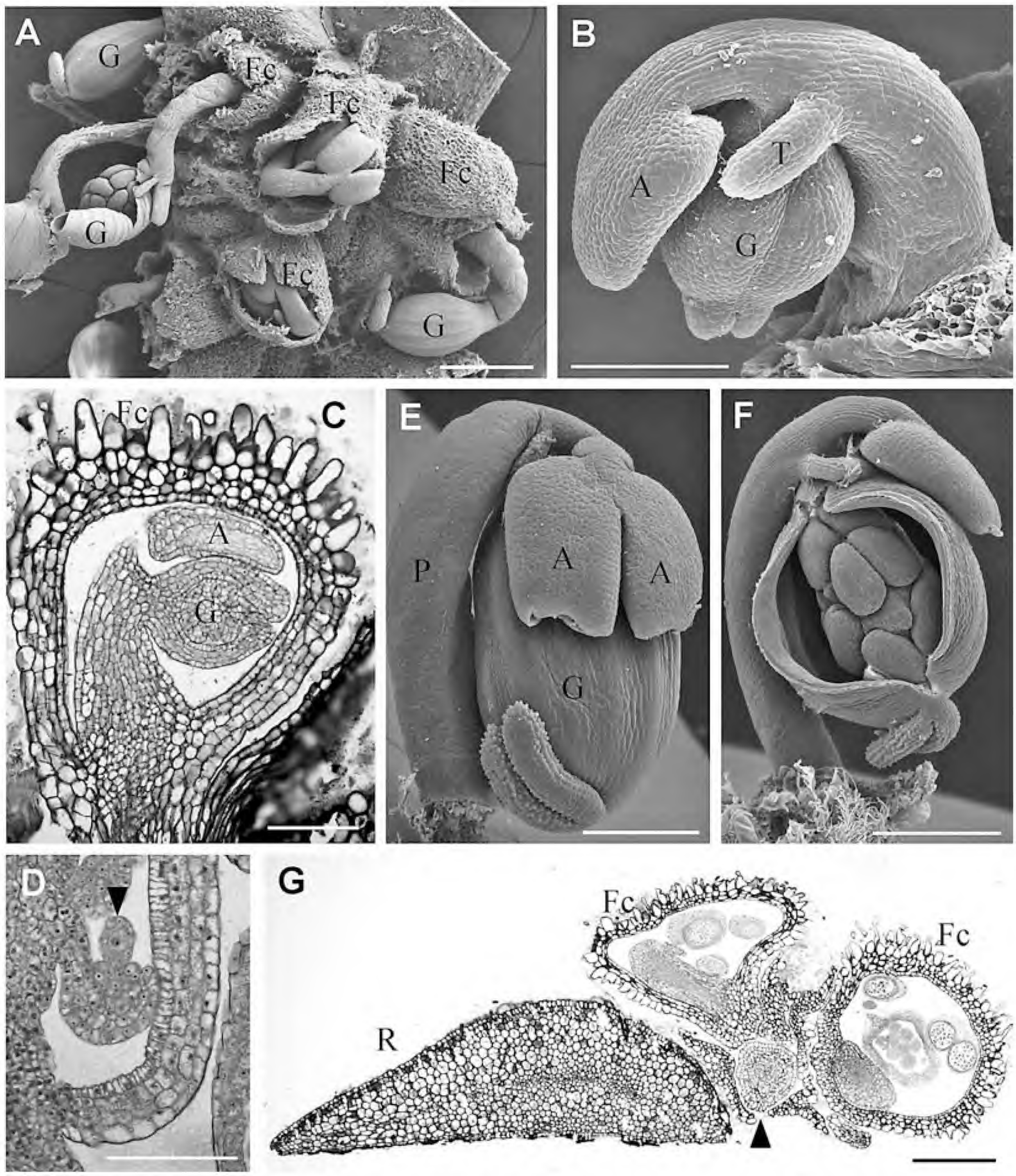

Figure 4. *Stonesia ghoguei* (from the type *Ghogue* GHO 1665). Reproductive structures, especially floral buds arising from stems and roots. —A. Cluster of floral buds on stem surface. Note presence of papillose spathellas (Fc), most of them ruptured in order to release anthers and gynoecia (G). Scale bar = 1 mm. —B. Strongly inclined floral bud (spathella removed), with young anther (A), ovary (G), and tepal (T). Scale bar = 200 μm. —C. Similar stage of strongly inclined floral bud inside spathella, with prominent papillae (Fc). Abbreviations as above. Scale bar = 100 μm. —D. Longitudinal section of young ovary, showing early stage of anatropous ovule, arising from central placenta. Note nucellar region (arrowhead) with megaspore cell projecting beyond the two primordial integuments. Scale bar = 100 μm. —E. Completely inverted floral bud on elongated pedicel (P) prior to anthesis (spathella removed). Ovary (G) with two linear stigma lobes. Note deep cleft between the two thecae (A). Scale bar = 400 μm. —F. Another completely inverted floral bud (spathella removed). The ovary (young capsule) partly dehisced. Note central placenta with few ovules (immature seeds) and without septum. Scale bar = 500 μm. —G. Cross section of ribbon-like root (R) with short shoot consisting of two flowers in spathellas (Fc). Arrowhead points to the "inflorescence axis," surrounded by scale-like bracts. Scale bar = 500 μm.

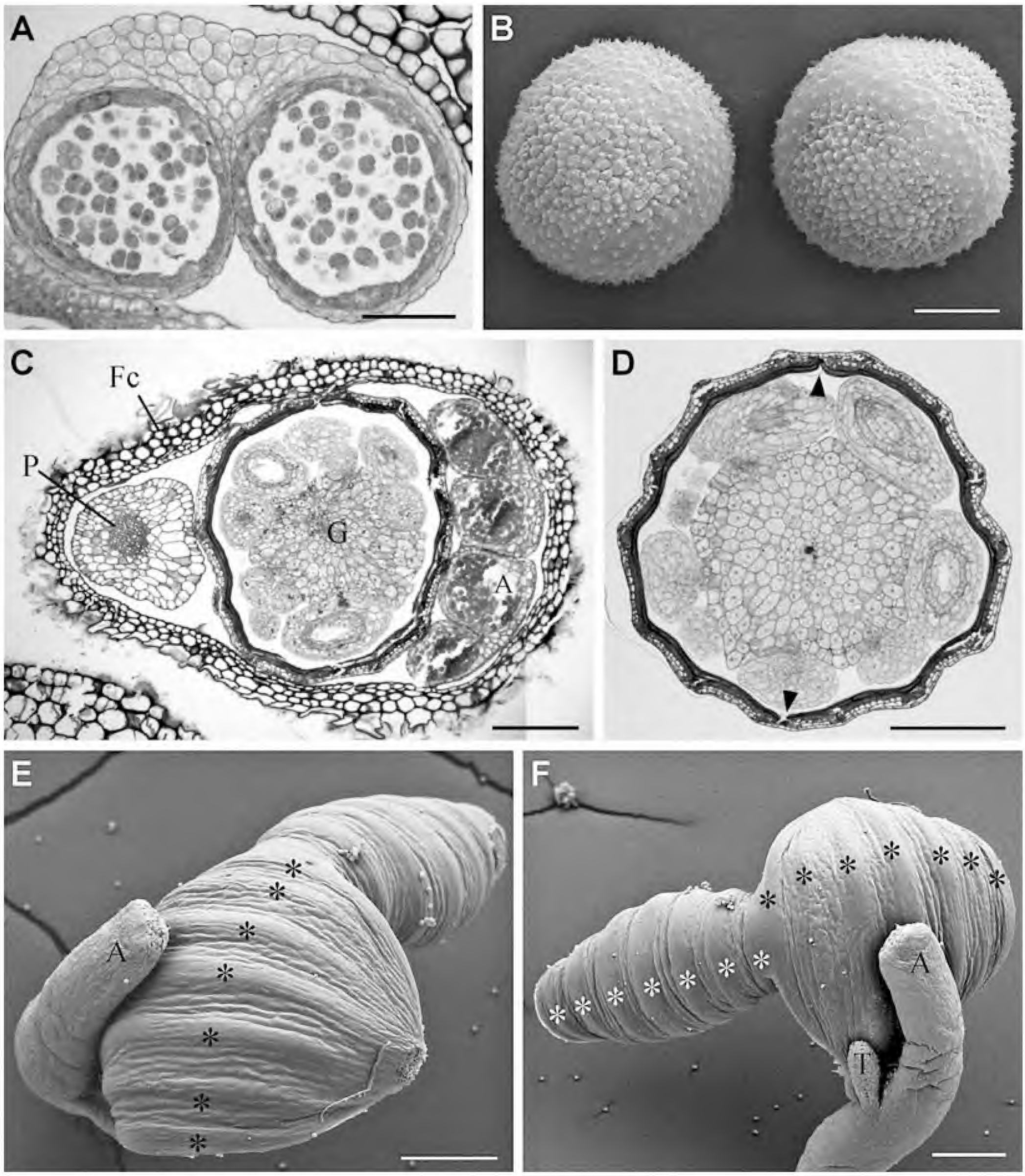

Figure 5. *Stonesia ghoguei* (from the type *Ghogue* GHO 1665). Reproductive structures such as stamen, pollen, ovary, and capsule. —A. Cross section of free theca tip with two pollen sacs. Immature pollen grains arranged in dyads and tetrads. Scale bar = 50 μm. —B. Two tricolpate pollen grains released as monads. Scale bar = 5 μm. —C. Cross section of anthetic flower prior to spathella (Fc) dehiscence. Note presence of pedicel (P), unilocular ovary (G) with 14 inconspicuous ribs, and anther with four introrse pollen sacs (A). Scale bar = 200 μm. —D. Nearly isolobous (immature) capsule, two valves with seven ribs each. Arrowheads point to the sutures along which the unilocular capsule will dehisce. Scale bar = 200 μm. —E, F. Two views of mature capsule, dehiscing into two nearly equal valves, each one with seven ribs. One valve stays attached to the base of the remaining floral parts (A = filament, T = tepal). Scale bars = 250 μm.

septum, ellipsoidal, with 2 thread-like stigmas; *capsule* widely ellipsoid, valves 2, equal or nearly so, ribs best observable when capsules mature; capsule valve with 5 or 7 ribs, ribs nearest the sutures shorter; *seeds* 15 to 20 per capsule.

Habitat and distribution. *Stonesia ghoguei* has been found in a strong waterfall on gneissic rock, on a 75°–80° slope. Due to the small population size, the very limited area of occupancy with just one location, and yet the lack of data on change in population size,

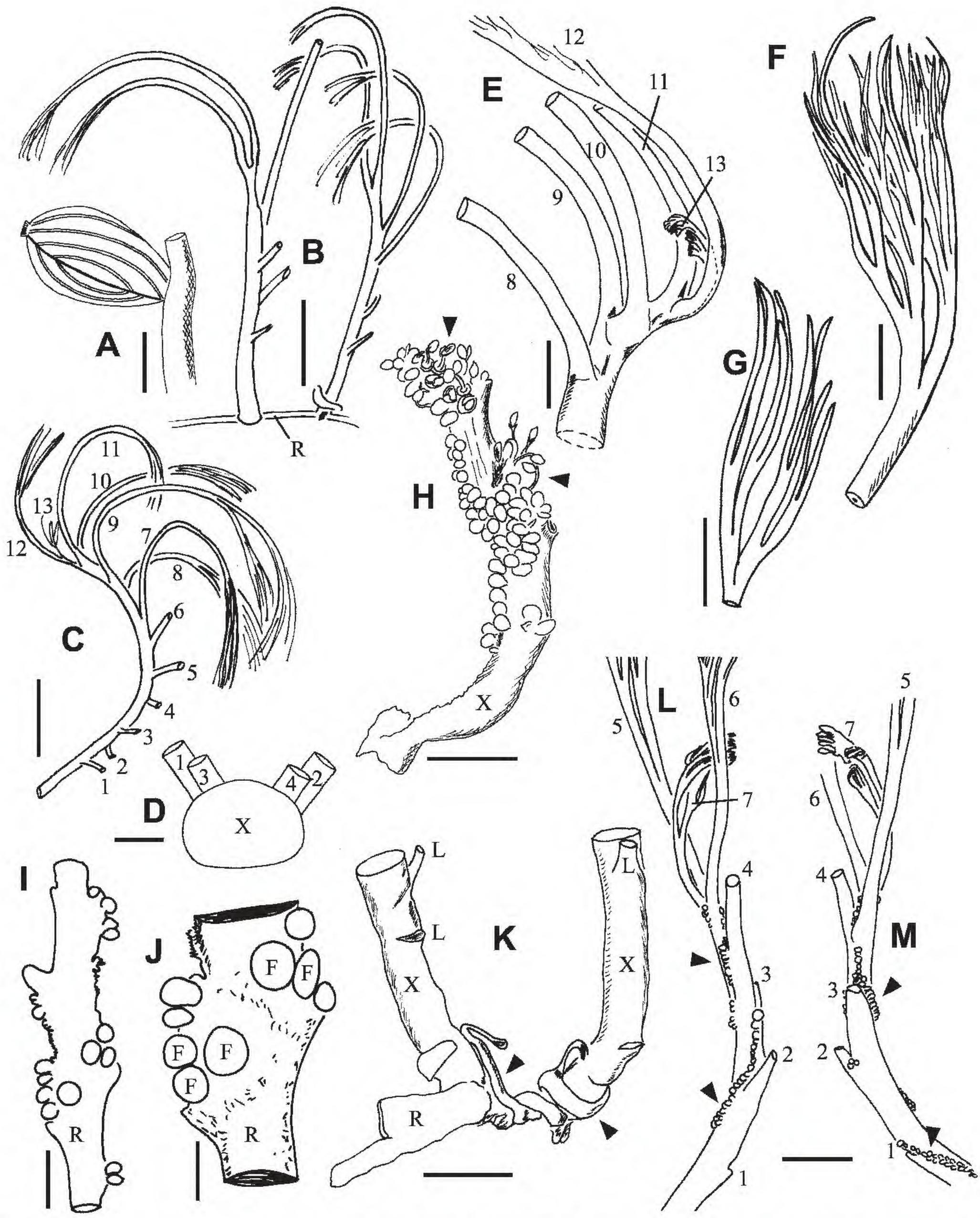

Figure 6. *Stonesia ghoguei* (from the type *Ghogue* GHO 1665: A–G, I–M; from the paratype *Ghogue* GHO 1668: H). —A. Nearly mature capsule with peculiar rib pattern as typical for *Stonesia*, *Endocaulos*, and *Paleodicraeia*. Scale bar = 0.5 mm. —B. Two vegetative shoots arising from ribbon-like root (R). Scale bar = 15 mm. —C. Distal portion of elongate vegetative shoot, lower leaves (1 to 6) dropped, upper leaves (7 to 13) with repeatedly forked blade. Scale bar = 15 mm. —D. Scheme illustrating dorsiventral distichy of vegetative shoot, leading to secund leaf arrangement (1 to 4) along stem (X). Scale bar = 1 mm. —E. Relative position of shoot tip shown in Figure 6C. Leaves 8 to 11 removed except for their petioles (see also Fig. 2A, B). Scale bar = 5 mm. —F. Nearly mature leaf with blade repeatedly forked. Scale bar = 5 mm. —G. Close-up of distal blade portion with three bifurcations. Scale bar = 5 mm. —H. Older stem portion (X, 4 cm long), covered with many sessile flower buds; arrowheads point to spathellas that rupture to release flowers for anthesis. Scale bar = 5 mm. —I, J. Portion of broad root ribbon (R), seen from above, with sessile flower buds (F) along margins and on upper root surface. Scale bars = 3 mm and 1.5 mm, respectively. —K. Proximal portions of two root (R)-borne stems (X), with basal leaves (L) already dropped. Arrowheads point to outgrowth of young roots coiling around stem base (see close-up, Fig. 1A). Scale bar = 5 mm. —L, M. Two opposite views of 4.5 cm long stem portion with proximal leaves (1 to 4) dropped and distal leaves (5 to 7) still present. Arrowheads point to emerging flower buds along oblique stem lines (see also close-ups in Fig. 3A, B). Scale bar = 10 mm.

we suggest the IUCN conservation status of Vulnerable (VU D1+2) (IUCN, 2001).

Etymology. The epithet of the new species honors the Cameroonian botanist Jean-Paul Ghogue (National Herbarium Yaoundé), who discovered this species in 2005.

Roots. Root architecture of *Stonesia ghoguei* is shown in Figures 1A–F, 6I–K. The roots are usually broad ribbons (to 5 mm broad), more rarely crustose structures resembling foliose lichens. Ribbons can turn into crusts by adding exogenous daughter lobes (Fig. 1B). Transverse sections show dorsiventrally flattened ribbons with a more or less planar lower surface fixed to the rock by adhesive hairs (Fig. 1C, E). The upper side of the ribbon contains some silica bodies, mainly in its hypodermis. The vascular tissue is a two-dimensional network of fine strands consisting of prosenchymatous cells, with phloem and xylem elements not distinguishable. Endogenous shoot buds and flowers originate from the root flanks (Fig. 1A, C, F), also from the sinus between two root lobes (Fig. 1B), and from the upper root surface (Fig. 6I, J). Additional roots grow out from the stem bases next to the mother root (Fig. 6K).

Vegetative shoots and leaves. Stem and leaf features of *Stonesia ghoguei* are shown in Figures 2A–G, 6B–F. The leaves appear to be restricted to one stem sector with internode lengths of 1 cm or less (Fig. 6C, E). This secund leaf arrangement is a dorsiventral variant of distichous phyllotaxis (as illustrated in scheme Fig. 6D). Dorsiventral distichy results from repetitive leaf initiation from the backside of the so far youngest leaves (Fig. 2A, B). Leaves of older stem portions are coiled backward (Fig. 6C), whereas young leaves next to the shoot tip are straight (Fig. 2B). Young leaves have stipular lobes, which become inconspicuous later. Mature foliage leaves consist of wiry petioles, which carry laciniate blades resulting from repeated bifurcations (Figs. 2C, 6F, G). Distal blade segments are slightly flattened, with chloroplasts restricted to the small-celled epidermis (Fig. 2D). Ultimate segments contain a weak vascular bundle each, whereas petioles and proximal segments are provided with a strong bundle each (Fig. 2F, G). No obvious phloem and xylem elements were detected in the leaves. The slightly concave side of young distal leaf segments are covered by hairs that soon wither and drop (Fig. 2A, C).

Position of flower buds. Flower buds (each covered with a sac-like spathella) arise along the root flanks and the upper root surface (Fig. 6I, J). These flowers are part of root-borne endogenous short shoots (Figs. 1C, F, 4G). Flower buds (solitary or in clusters) also arise along the stem without subtending leaves. Occasionally, there are hundreds of flowers covering a stem (Fig. 6H), or they are restricted to oblique stem lines, continuing the insertion zones of the leaves along the stem, with the stem sector just below leaf insertion not covered by flowers (Fig. 6L, M). The endogenous buds inside the stem cortex have the morphogenetic potential to create new floral buds ad infinitum or nearly so, intermingled with rudimentary scaly leaves (Fig. 3A–D). However, the rather large-celled tissue in the stem sector just below a leaf (L in Fig. 3C, D) lacks this morphogenetical potential. The vascular tissue of mature stem portions consists of narrow cells (again, no obvious phloem and xylem), being compact (Fig. 3C) or arranged in a bow surrounding a parenchymatous pith (Fig. 3D). Flower buds were also observed on the leaves, arising from the clefts of proximal blade forks (Fig. 2E). There may be one or few floral buds per fork (Fig. 2F). Epiphyllous buds occasionally start with a small leaf prior to the outgrowth of flowers (Fig. 2G).

Spathellas as covers for flower buds. The sac-like spathella covering a flower bud is four to five cells thick (Figs. 2F, 3D). It lacks any vascular tissue and carries papillae except for the basal zone (Fig. 4C, G). Young flower buds are inclined, with the pedicel axis and the ovary axis forming angles of 45°–90° (Fig. 4B, C). Fully developed flowers are pedicellate and completely inverted inside the spathella, with the stigma facing the base (Figs. 4E, 5C). At anthesis, the spathella ruptures with irregular distal teeth (Fig. 4A).

Flowers and their parts. Flowering and fruiting in the natural habitat (Tello Waterfalls) reached a peak in February and March 2005, when the type and paratype (GHO 1665 and GHO 1668) were collected by J. P. Ghogue. The pedicel (floral stalk) continues to elongate as the spathella ruptures, pushing the young flower out of the broken spathella. The inverted stalked ovary and the single stamen assume an inclined to upright position (Figs. 4A, 6A). Each flower has two subulate (linear) tepals (Fig. 4B, F). The androecium consists of a single stamen with a prominent distal incision between the two thecae (Fig. 4E). Pollen sac dehiscence is introrse (Fig. 5C). The ovary is ellipsoidal, 1–1.5 mm long. There are two linear stigma lobes (Fig. 4E). The ovary is unilocular with free central placentation of 15 to 20 ovules, most of them becoming seeds (Figs. 4F, 5C, D). The mature ovules are anatropous, bitegmic, and tenuinucellate, with the nucellus exceeding the inner integument. This nucellar protuberance (containing the megaspore cell) is already observable in young ovules (Fig. 4D) when both integuments are still much shorter. Pollen grains during anthesis are mainly

monads (Fig. 5B) besides few dyads, whereas immature anthers contain mainly dyads (Fig. 5A). Thus, it looks as if the dyads in this species fall apart quite easily. The pollen wall is slightly echinate and has three inconspicuous colpi (Fig. 5B).

Capsules. After anthesis, the flower stalks (pedicels) elongate up to 4 mm; a gynophore is lacking (Figs. 5F, 6H). The pedicels initially consist of a sclerenchymatous central cylinder and a parenchymatous cortex (Fig. 5C). The capsule walls and the capsule stalks (pedicels) lose their parenchymatous cortex during the maturation process, as is typical for Podostemaceae. Thus, the rib pattern as already observable in anthetic ovaries becomes more prominent afterward. There are five to seven ribs per capsule valve plus the sutures, as is typical for *Stonesia* in general (Fig. 5C–F). The ribs nearest to the sutures do not run the whole capsule length, but begin on the suture above the base and, curving parallel to the other ribs, rejoin it below the apex (Fig. 6A). One (rarely both) of the equal valves is shed after capsule dehiscence. The capsules may split along one suture first, and later along the second one (Figs. 4A, F, 5F).

Molecular data. The aligned sequence length was 1542 bp. The selected optimal model of sequence evolution was the TVM + G model: unequal base frequencies (A = 0.3320, C = 0.1467, G = 0.1263) and six substitution types (A/C: 1.3211, A/G: 1.4110, A/T: 0.2497, C/G: 0.9004, C/T: 1.4110), gamma distribution of rates among sites with alpha shape parameter 0.4785. The analysis using these parameters yielded one optimal ML tree with a log-likelihood score of $-\ln L = 4932.70$ (Fig. 7). The African podostemoid species included in the current analysis were monophyletic, with the two Madagascan genera *Endocaulos* and *Thelethylax* as sister. *Ledermanniella* subg. *Phyllosoma* C. Cusset (including *L. ledermannii*, *L.* cf. *bosii*) was paraphyletic to all other Podostemoideae studied from the African continent, including *Dicraeanthus* Engler, *Djinga* C. Cusset, *Stonesia*, and four species belonging to *Ledermanniella* subg. *Ledermanniella*. The results shown in Figure 7 are identical to those presented by Moline et al. (2007) with respect to the set of non-African podostemoids.

Paratype. CAMEROON. **Adamawa:** Ngaoundéré, Tello Waterfalls, 10 Mar. 2005, *J.-P. Ghogue* GHO 1668 (K, YA, Z). Figure 6H.

Discussion

MOLECULAR DATA

Recently published molecular data indicate that there are two large groups among African Podostemoideae (Kita et al., 2005; Moline et al., 2007). One is a grade composed of *Ledermanniella* subg. *Phyllosoma*, the other one is a clade composed of *Ledermanniella* subg. *Ledermanniella* and various small genera nested within, e.g., *Dicraeanthus* (two species, Cameroon) and *Djinga* (monotypic, Cameroon). In the present study, we show that GHO 1665, which we regard as a new Cameroonian member of the genus *Stonesia*, is also nested in this large clade (Fig. 7), confirming the artificialness of the genus *Ledermanniella*, especially its subgenus *Ledermanniella*. The genus *Stonesia* is characterized by an increased number of capsule ribs and the ribs close to the sutures not reaching the base and tip of the capsule. This pattern is similar to *Endocaulos* and *Paleodicraeia* C. Cusset (both from Madagascar), but unlike all other Podostemoideae from Continental Africa. With the molecular data shown in Figure 7, the phylogenetic distance between *Stonesia* and *Endocaulos* becomes obvious, and we can confirm the peculiar pattern of capsule ribs they have in common as homoplasies. However, we should consider that the inclusion of additional genes and additional taxa may change the topology of the African podostemoids already studied. As shown above, there are no conclusive molecular data available at the moment, except for the view to merge genera such as *Dicraeanthus*, *Djinga*, and *Stonesia* into the large African genus *Ledermanniella*, which appears paraphyletic without them (Fig. 7). Alternatively, splitting the heterogenous *Ledermanniella* into monophyletic, morphologically uniform groups could be implemented when sufficient molecular data become available.

HOW TO DEFINE GENERA IN AFRICAN PODOSTEMOIDEAE?

As shown in Cook and Rutishauser (2007), a set of few easily recognizable features was enough to describe a new podostemaceous genus in earlier days, until the advent of molecular systematics. Podostemoid genera, which are not difficult to define morphologically, include in Africa *Dicraeanthus*, *Djinga*, and *Stonesia*. *Djinga* (one sp.) is recognizable because of globular smooth capsules (lacking ribs or nearly so), also by oblique flower buds inside the spathella (i.e., not being completely inverted as in typical *Ledermanniella*). *Dicraeanthus* and *Stonesia* (both with completely inverted flower buds) are recognizable by other characters not observable in *Ledermanniella*: *Dicraeanthus* showing elongate ovaries (capsules) with short conical stigma lobes; *Stonesia* showing an increased number of capsule ribs with the ribs close to the sutures not reaching the base and tip of the capsule. Thus, we prefer as a preliminary hypothesis to acknowledge the value of

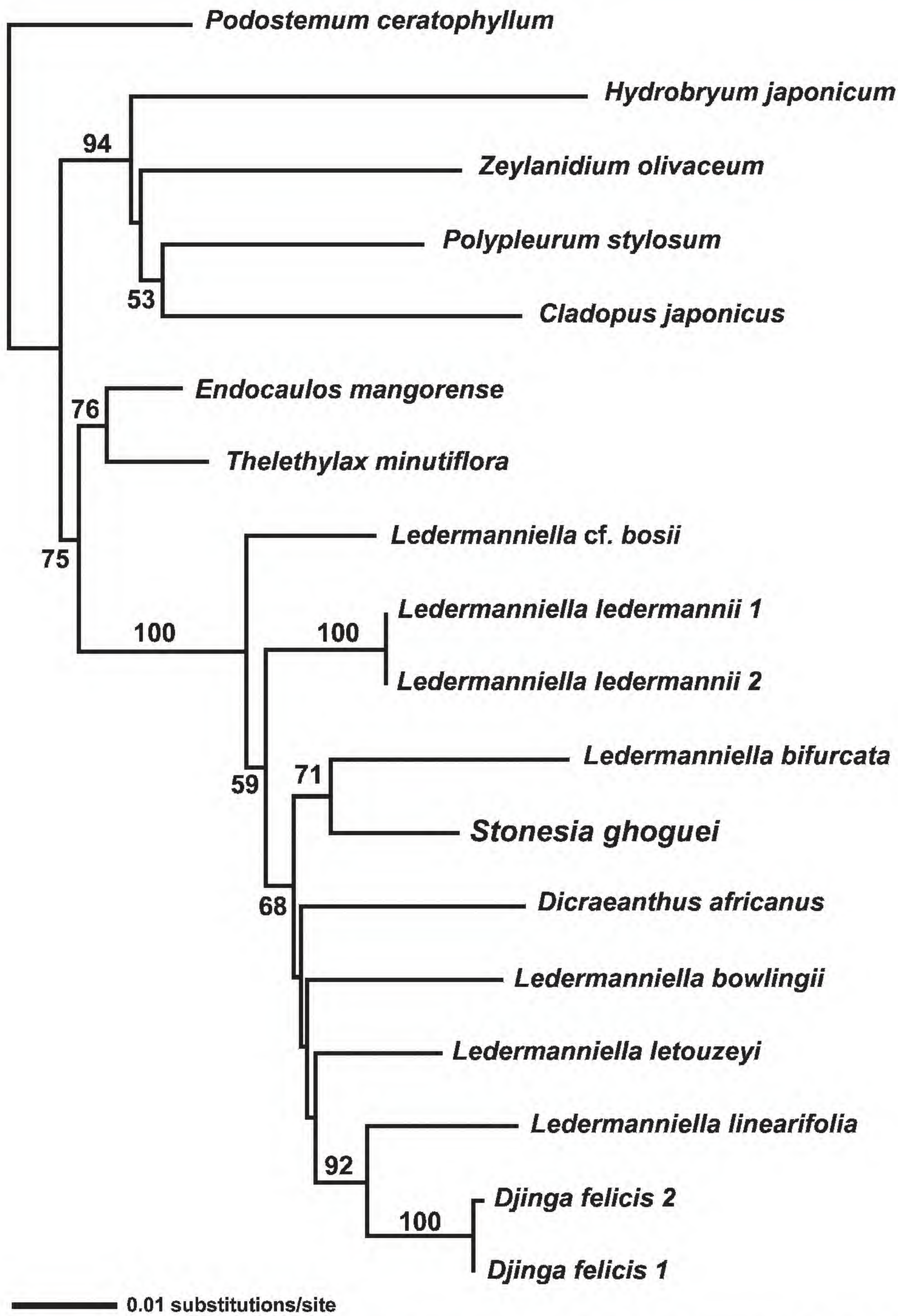

Figure 7. Maximum likelihood tree (−lnL = 4932.70) of phylogenetic analysis of Podostemaceae–Podostemoideae from Continental Africa (species of *Dicraeanthus*, *Djinga*, *Ledermanniella*, *Stonesia*), Madagascar (*Endocaulos*, *Thelethylax*), Asia (*Cladopus* H. Möller, *Polypleurum*, *Hydrobryum* Endlicher, *Zeylanidium*), and America (*Podostemum*), based on *matK* sequence data (aligned sequence length 1542 bp). A modified data set by Moline et al. (2007) (tree base M2581) was used, and *Stonesia ghoguei* (GenBank Acc. No. AM937251) was added. A maximum likelihood (ML, Felsenstein, 1981) analysis was performed using PAUP 4.0. The analysis using these parameters yielded one optimal ML tree with a log-likelihood score of −lnL = 4932.70. Bootstrap support is indicated above branches. For further explanation, see text.

crisp sets of morphological characters, which allow identification of podostemoid genera in the field, over monophyly (cf. Nordal & Stedje, 2005). By keeping genera such as *Dicraeanthus*, *Djinga*, and *Stonesia*, these sets of characters have a label, which makes communication about African Podostemoideae easier. Moreover, we think it is best to describe *S. ghoguei* (GHO 1665 and GHO 1668) as a new Cameroonian species of the genus *Stonesia*. Further molecular studies, including the *Stonesia* members from Guinea and Sierra Leone, are needed to verify or falsify this mainly morphological approach to taxonomy. Unfortunately, the three western *Stonesia* species seem to be endangered too and are not readily available for comparative and molecular studies.

STONESIA GHOGUEI AS A SOMEWHAT ABERRANT MEMBER OF THE GENUS *STONESIA*

The genus *Stonesia* has capsule valves with five or seven ribs, the ribs nearest to the sutures are shorter than others and do not reach the ends of the valves. Unlike the western *Stonesia* species (from Guinea and Sierra Leone), *S. ghoguei* has pollen released mainly in monads (not dyads), one stamen per flower with two lateral tepals (not two stamens with three tepals), and moreover, *S. ghoguei* has unilocular ovaries, not bilocular ones as described for the western *Stonesia* species. Comments for these three seemingly deviating characters will be given below:

Monads versus dyads. Most podostemoids show tricolpate pollen (Cook & Rutishauser, 2007). The pollen grains in the presumably basal New World genera such as *Apinagia* Tulasne, *Marathrum* Bonpland, and *Mourera* Aublet are shed in monads. In more derived podostemoids, including all Asian, all Madagascan, and many African taxa, they are shed in dyads (Cook & Rutishauser, 2007). According to Jäger-Zürn et al. (2005), occurrence of monads in Podostemaceae appears to be correlated with simultaneous microsporogenesis, whereas dyads are mainly found in podostemoid taxa with successive microsporogenesis, e.g., *Polypleurum* (Tulasne) Warming and *Zeylanidium* Engler from southern Asia. The large African genus *Ledermanniella* shows both monads and dyads, depending on the species (Cusset, 1983, 1984, 1987). In *Djinga* (monotypic, Cameroon) and *Stonesia* (*S. ghoguei*), the dyads seem to decay easily into monads. Ghogue et al. (in prep.) found ca. 80% dyads and ca. 20% monads in nearly mature anthers of *D. felicis*. In *S. ghoguei*, most pollen grains leave the dehiscing anthers as monads. However, many dyads are still observable in the premature anthers (Fig. 5A, B). In the three western *Stonesia* species, the released pollen are also described as dyads (Taylor, 1953; Cusset, 1973). Thus, it is best to accept the two character states "monads" versus "dyads" as less contrasting and exclusive as usually thought for the distinction of podostemoid genera (Cook & Rutishauser, 2007).

One stamen versus two stamens per flower. Unlike *Stonesia ghoguei*, the flowers of the three western *Stonesia* species show two fused stamens on a common foot (called "andropodium") plus three subulate tepals, one tepal on each side of the andropodium, and the third tepal in the fork between the filaments. This character state also occurs in the Madagascan genus *Thelethylax* and the American genus *Podostemum* Michaux (Philbrick & Novelo, 2004; Moline et al., 2006). In both genera (*Podostemum*, *Thelethylax*), there are known species or populations lacking the third median tepal (Grob et al., 2007). The switch from two stamens with andropodium to flowers with a single stamen may appear as crucial for species delimitation. However, both patterns can be found even within the same species. For example, flowers with two stamens (on a common andropodium) besides flowers with a single stamen are known in *Letestuella tisserantii* G. Taylor (western tropical Africa) and *Oserya coulteriana* Tulasne (Mexico), as already described by Warming (1899), Taylor (1953), Cusset (1980), and Novelo and Philbrick (1997).

Unilocular versus bilocular ovaries. The bicarpellate ovary of Podostemoideae can be either bilocular, with a prominent central placenta and a thin septum, or it can be unilocular lacking a septum, as found in *Stonesia ghoguei*. Bilocular ovaries represent the plesiomorphic condition in podostemoids, occurring in most non-African members, but in only a few African and Madagascan taxa such as *Endocaulos*, *Sphaerothylax* Bischoff ex C. Krauss, *Thelethylax*, and *Saxicolella* Engler p.p. (Jäger-Zürn, 2000; Ameka et al., 2002; Cook & Rutishauser, 2007; Moline et al., 2007). Cusset (1973) described the three western *Stonesia* species as having bilocular ovaries. Taylor (1953) did not yet consider this character. We checked additional herbarium material of *S. fascicularis* G. Taylor and *S. heterospathella* G. Taylor in Z/ZT, confirming the presence of a septum. Thus, both unilocular and bilocular ovaries are found as character states in *Stonesia*. Here we have to keep in mind that unilocular ovaries also have a rudimentary septum in the basal ovary region, as observable in *Djinga felicis* (Ghogue et al., in prep.) and *Ledermanniella bowlingii* (Ameka et al., 2003).

COMPARISON OF *STONESIA GHOGUEI* WITH OTHER AFRICAN AND MADAGASCAN PODOSTEMOIDS

Various characters of *Stonesia* (including *S. ghoguei*) are found in some or a few other African podostemoids. Comments are given below regarding six characters:

Flower buds are inverted in spathella. The inverted flower in the unruptured spathella is a synapomorphy of various African and Madagascan members (including *Stonesia*), whereas an upright (erect) flower in the unruptured spathella is plesiomorphic (Moline et al., 2007). African podostemoids such as *Stonesia* have completely inverted flowers inside fully developed spathellas, even though they start with inclined ovaries in early developmental stages. They become inverted by pedicel elongation inside the growing spathella (Fig. 4B, C). The Madagascan podostemoids with an increased number of capsule ribs (similar to *Stonesia*) are *Endocaulos* and *Paleodicraeia*. The two latter genera, however, show erect or only slightly inclined flower buds inside the spathella (Cook & Rutishauser, 2007; Grob et al., 2007).

Crustose roots or broad ribbons have exogenous daughter roots covering the rocky substrate. The three *Stonesia* species from Guinea and Sierra Leone (i.e., the western *Stonesia* species) are described as having crustose roots, whereas, for example, the roots of other African genera and the Madagascan *Paleodicraeia* and *Thelethylax* are narrow to broad ribbons, with the root cap absent or present (Ameka et al., 2002; Rutishauser & Moline, 2005; Koi et al., 2006; Moline et al., 2007; Rutishauser et al., 2008). *Stonesia ghoguei* behaves somewhat intermediate by producing ribbons that can turn into crusts by adding broad lateral lobes (daughter roots) that arise exogenously from the mother root (Fig. 1A–F). *Stonesia ghoguei* roots lack a cap, similar to the western *Stonesia* species.

Stems are usually simple, up to 10 cm long in Stonesia ghoguei. Prominent and rather thick stems (monopodial, rarely branched) are also found in the western *Stonesia* species. In *S. fascicularis* the stems can be up to 40 cm long, whereas *S. heterospathella* and *S. taylorii* C. Cusset have stem lengths around 10 cm, i.e., similar to *S. ghoguei* (Taylor, 1953; Cusset, 1973). Simple or rarely branched stems of 10–30 cm lengths are also known from *Dicraeanthus africanus* and *Ledermanniella letouzeyi* (Moline et al., 2007). We could not observe double-sheathed leaves in *S. ghoguei*. These are leaves with two sheaths that are inserted laterally and opposite each other. Double-sheathed leaves occur in many podostemoids with elongate stems that are branched (Moline et al., 2006, 2007).

Cauliflory is due to endogenous origin of flower buds inside the stem cortex. *Stonesia ghoguei* has plenty of sessile flower buds covering the stem surface and not being subtended by leaves. These flowers arise from endogenous buds inside the stem cortex, they protrude the stem periphery, rupturing the outer cortex layers and the epidermis (Fig. 3C, D). Similarly, *Dicraeanthus africanus*, *Ledermanniella letouzeyi*, and *Macropodiella heteromorpha* (Baillon) C. Cusset are able to produce hundreds of flowers from endogenous buds formed inside the stem cortex (Rutishauser & Moline, 2005; Cook & Rutishauser, 2007; Moline et al., 2007; Rutishauser et al., 2007; Pfeifer et al., unpublished data). The drawings of M. Stones (published in Taylor, 1953) show a similar floral arrangement (i.e., cauliflory) in the western *Stonesia* species, especially in *S. fascicularis*. Because Stones and Taylor did not present microtome sections, we only can assume that cauliflory in *S. fascicularis* is also due to endogenous bud inception inside the stem cortex. *Stonesia taylorii* (described as additional Guinean species by Cusset, 1973) carries either rudimentary or well-developed flowers along two stem sectors.

Leaves are repeatedly forked into narrow segments, with epiphyllous flowers arising from the clefts of the forks. *Stonesia ghoguei* is peculiar by carrying additional flowers on the leaves. There are up to 15 epiphyllous flowers arising from each of the proximal clefts of the repeatedly forked blade (Fig. 2E–G). Epiphyllous flowers are also known from two Cameroonian *Ledermanniella* species: *L. letouzeyi* and *L. prasina* J. J. Schenk & D. W. Thomas (Schenk & Thomas, 2004; Rutishauser & Moline, 2005; Moline et al., 2007). The drawings by M. Stones (published in Taylor, 1953) show similar patterns in the western *Stonesia* species, especially in *S. heterospathella*.

There are few scale-like leaves (bracts) below each spathella. The three western *Stonesia* species are distinguishable from each other by the shape of the bracts of the reproductive short shoots. *Stonesia taylorii* (as described by Cusset, 1973) is characterized by two to six trifid or quadrifid bracts per one-flowered short shoot, whereas in the two other western *Stonesia* species the few bracts below each spathella are entire or inconspicuous. Similarly, the bracts accompanying the few-flowered short shoots in *S. ghoguei* are usually entire and only rarely lobed (Figs. 3C, D, 4G). Two types of spathellas, as described by Taylor (1953) in *S. heterospathella*, were not observed in *S. ghoguei*.

Conclusions

The developmental and morphological studies of the Cameroonian specimens collected by J. P. Ghogue (GHO 1665 & GHO 1668) indicate that it is best to describe them as a new species, belonging to *Stonesia*, mainly due to the presence of the very peculiar pattern of capsule ribs. The similar rib pattern in Madagascan genera (*Endocaulos*, *Paleodicraeia*) evolved independently in a clade also comprising *Thelethylax* (Grob et al., 2007; Thiv et al., in prep.).

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Name Changes in the *Mentzelia multicaulis* Complex (Loasaceae)

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Abstract. Results from molecular phylogenetic analyses indicate that three varieties of *Mentzelia multicaulis* (Osterhout) J. Darlington (Loasaceae) are more closely related to other species of *Mentzelia* sect. *Bartonia* Torrey & A. Gray than to *M. multicaulis* var. *multicaulis*. We elevate three varieties of *M. multicaulis*, originally described from Utah, to specific rank, recognizing them as *M. librina* (K. H. Thorne & F. J. Smith) J. J. Schenk & L. Hufford, *M. flumensevera* (N. H. Holmgren & P. K. Holmgren) J. J. Schenk & L. Hufford, and *M. uintahensis* (N. H. Holmgren & P. K. Holmgren) J. J. Schenk & L. Hufford. Both stamen and leaf shape characters support evolutionary relationships of these species with their closest relatives among the mentzelias found in the Intermountain West of the United States.

Key words: Intermountain West, Loasaceae, *Mentzelia*, United States, Utah.

Mentzelia L. (Loasaceae) has its greatest taxonomic and morphological diversity in western North America. Much of this diversity is centered in *Mentzelia* sect. *Bartonia* Torrey & A. Gray, which has presented considerable taxonomic problems (Holmgren & Holmgren, 2002). Recent studies of mentzelias in the Intermountain West have expanded our knowledge of morphological diversity and increased substantially the number of recognized taxa in *Mentzelia* sect. *Bartonia* to approximately 50 species (Thompson & Prigge, 1984, 1986, 2004; Prigge, 1986; Thorne, 1986; Thorne & Smith, 1986; Christy, 1997, 1998; Holmgren & Holmgren, 2002; Reveal, 2002; Welsh et al., 2003; Holmgren et al., 2005).

Some of the recently discovered diversity in *Mentzelia* sect. *Bartonia* has been circumscribed as varieties of *M. multicaulis* (Osterhout) J. Darlington (Thorne & Smith, 1986; Holmgren & Holmgren, 2002). Osterhout (1903) first used the specific epithet *multicaulis* in *Touterea* Eaton & Wright to denote collections from Eagle County, Colorado, on the western slope of the Rocky Mountains. *Touterea* was later combined with *Mentzelia* by Darlington (1934). The concept of *M. multicaulis* was expanded by Thorne and Smith's (1986) description of *M. multicaulis* var. *librina* K. H. Thorne & F. J. Smith. This endemic of the Book Cliffs of eastern Utah was distinguished from *M. multicaulis* var. *multicaulis* as a more robust plant with trilobed rather than pinnatifid to linear leaves and shorter seeds (Thorne & Smith, 1986). Holmgren and Holmgren (2002) further expanded the concept of *M. multicaulis* with the description of the varieties *uintahensis* N. H. Holmgren & P. K. Holmgren and *flumensevera* N. H. Holmgren & P. K. Holmgren. Holmgren and Holmgren (2002) recognized the four varieties of *M. multicaulis* as sharing a subshrubby habit comprised of shoots with many zigzagged branches arising from a subterranean, woody caudex and possessing short (1.5–3[–5] cm) cauline leaves that are deeply pinnatifid with three to seven (to 11) segments or entire, flowers that have five, broadly spatulate or suborbicular, shortly clawed petals that are 9–20 × 2–9(–11) mm and five petaloid stamens that are 7–12(–15) × 1.2–7(–9) mm, and seeds with coats that have straight anticlinal walls and three to 10 papillae per cell among other traits.

Holmgren and Holmgren (2002) also called attention to several other *Mentzelia* species of the American Intermountain West, including *M. argillicola* N. H. Holmgren & P. K. Holmgren, *M. argillosa* J. Darlington, *M. rhizomata* Reveal, and *M. shultziorum* Prigge, that shared many morphological attributes with, and were geographically close to, one or more of the *M. multicaulis* varieties. These Intermountain species, like *M. multicaulis*, were also found on steep slopes of talus or otherwise loose substrate. Our molecular phylogenetic studies, which have broadly sampled species of *Mentzelia* sect. *Bartonia* for variation in sequences of the ITS-1 and ITS-2 and the ETS region of nuclear ribosomal DNA, recovered a paraphyletic *M. multicaulis* sensu Holmgren and Holmgren (2002). Our results showed the varieties of *M. multicaulis* to be more closely related to other Intermountain West species than to each other (Schenk & Hufford, in prep.). For example, *M. multicaulis* var. *multicaulis* was recovered as sister to *M. rhizomata*, *M. multicaulis* var. *librina* was sister to *M. shultziorum*, *M. multicaulis* var. *uintahensis* was sister to the *M. multicaulis* var. *librina* and *M. shultziorum* clade, and *M. multicaulis* var. *flumensevera* was sister to *M. argillicola*. Based on the robust phylogenetic signal, including substantial patristic

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distance among the varieties of *M. multicaulis*, and the morphological distinctiveness of the species most closely related to the different varieties of *M. multicaulis*, we elevate the varieties *flumensevera*, *librina*, and *uintahensis* of *M. multicaulis* to specific rank.

1. **Mentzelia multicaulis** (Osterhout) J. Darlington, Ann. Missouri Bot. Gard. 21: 156. 1934. Basionym: *Touterea multicaulis* Osterhout, Bull. Torrey Bot. Club 30: 237. 1903. TYPE: U.S.A. Colorado: Eagle Co., Wolcott, 11 July 1902, *G. E. Osterhout 2663* (holotype, RM; isotypes, CAS, COLO, NY, POM, RM).

Distribution and habitat. *Mentzelia multicaulis* occurs on the western slope of the Rocky Mountains, in Eagle, Summit, and Grand counties, Colorado. It occurs on sparsely vegetated slopes at 1800–2600 m elevation.

Relationships. *Mentzelia multicaulis* is most closely related to *M. rhizomata*, which is also distributed on the western slope of the Colorado Rocky Mountains. The variety *multicaulis* was distinguished from the other varieties by, among other traits, its much broader petals (5–9 mm; measurements from Holmgren & Holmgren, 2002) and the width of its median antesepalous stamens (the single outermost stamen directly opposite each sepal, sensu Hufford [1990, 2003]; 2–3.5[–4.5] mm). *Mentzelia rhizomata* is similar in possessing broad petals (6.1–9.6[–11.2] mm) and slightly wider median antesepalous stamens (4.2–6.2 mm). The basal leaves of *M. multicaulis* are lobed, whereas the more distal leaves are less prominently lobed to entire (Fig. 1A). The basal leaves of *M. rhizomata* are less prominently lobed, having undulate to toothed margins, and, like *M. multicaulis*, have more distal leaves that are usually entire (Fig. 1B).

Additional specimens examined. U.S.A. **Colorado:** Eagle Co., on hills 0.3 mi. N of Walcott [Wolcott], *H. J. Thompson 3205* (UTC); Colorado River Canyon, State Bridge, N of bridge, *N. H. Holmgren & P. K. Holmgren 14486* (NY, UTC); along State Rte. 9, 0.8 km N of Summit Co. line, 17.4 km S of downtown Kremmling, *N. H. Holmgren & P. K. Holmgren 15062* (NY, UTC); State Rte. 131, 12.7 km N of Wolcott, *N. H. Holmgren & P. K. Holmgren 14485* (NY, UNLV, UTC, WS); N of Wolcott along State Rte. 131, 0.5 km N of Eagle River bridge, *N. H. Holmgren & P. K. Holmgren 14484* (NY, RENO, UTC); along Colorado Hwy. 131, 0.4 mi. N of U.S. Hwy. 6 at Wolcott, *J. L. Reveal 7246* (NY); Wolcott, *Bessey 5290* (NY); E rim of Dotsero Crater, 1 mi. NE of Dotsero, *W. Baker & T. Naumann 82-370* (NY); Rte. 131, just N of Wolcott on E side of rd., *J. Schenk 1867* (WS); Rte. 1, just N of jct. with Colorado River, *J. Schenk 1884* (WS). Grand Co., S of Kremmling, 1.8 mi. SW on Co. Rd. 1 from Rte. 9, *K. W. Eberle 495* (UTC); Red Mtn., 1.5 mi. E of Kremmling, *B. E. Neely 5166* (UTC); W side of Muddy Creek, 2 mi. NNW of Kremmling, *E. Neese & O. Grah 17166* (NY); Sulphur Springs, *G. E. Osterhout 3562* (NY); Rte. 191, just N of intersection w/Rte. 1, *J. Schenk 1894* (WS). Summit Co., SE end of Green Mtn. Reservoir, along State Rte. 9, 10.8 km S of Grand Co. line, *N. H. Holmgren & P. K. Holmgren 15061* (NY, UTC).

2. **Mentzelia flumensevera** (N. H. Holmgren & P. K. Holmgren) J. J. Schenk & L. Hufford, stat. nov. Basionym: *Mentzelia multicaulis* (Osterhout) J. Darlington var. *flumensevera* N. H. Holmgren & P. K. Holmgren, Syst. Bot. 27: 761. 2002. TYPE: U.S.A. Utah: Piute Co., Sevier River, in a small draw W of U.S. Hwy. 89, 5.5 km N of downtown Marysvale, 1900 m, on SW-facing, fine gravel talus, 18 Aug. 2001, *N. H. Holmgren & P. K. Holmgren 14507* (holotype, NY; isotypes, BRY, COLO, NY, RM, UTC, WS).

Distribution and habitat. *Mentzelia flumensevera* is narrowly distributed along the Sevier River Canyon in the Tushar Mountains of Piute County, Utah. *Mentzelia flumensevera* occurs between 1800 and 1900 m elevation on steep south- or southwest-facing talus slopes comprised of gypsum-rich soils.

Relationships. *Mentzelia flumensevera* is most closely related to *M. argillicola*, which is located in Lincoln County, Nevada. Populations of *M. argillosa*, which is sister to the *M. flumensevera* and *M. argillicola* clade (Schenk & Hufford, in prep.), are found as close as 30 km to the northeast of *M. flumensevera* in Sevier and Sanpete counties, Utah. Like *M. flumensevera*, both *M. argillicola* and *M. argillosa* occur on gypsum-rich substrates.

Median antesepalous stamens that have petaloid forms in which the filaments are narrowly spatulate to oblanceolate with attenuate bases have been used to distinguish the *Mentzelia multicaulis* varieties *flumensevera* and *multicaulis* from *librina* and *flumensevera* (Holmgren & Holmgren, 2002; Holmgren et al., 2005). These stamen characters are also found in *M. argillicola* and *M. argillosa*, most likely due to their common evolutionary history. The leaf margins of *M. argillosa* (Fig. 1C) are mostly entire and similar leaf forms are found on the shoots of *M. argillicola* (Fig. 1D), although some of the more distal leaves of the latter are shallowly lobed. *Mentzelia flumensevera* differs from its closest relatives in having leaves that are distinctly lobed over the length of the shoot system (Fig. 1E). Leaves of all three of these species appear grayish green due to their copious trichomes.

Additional specimens examined. U.S.A. **Utah:** Piute Co., Tushar Mtns., Big Rock Candy Mtn., *A. Taye 4241* (RM); Marysvale Canyon, ca. 2.7 mi. NNW of Marysvale, *A. Taye 3424* (NY, RM); Sevier Canyon, along U.S. Hwy. 89, 7 km N of downtown Marysvale, W of hwy., *N. H. Holmgren & P. K.*

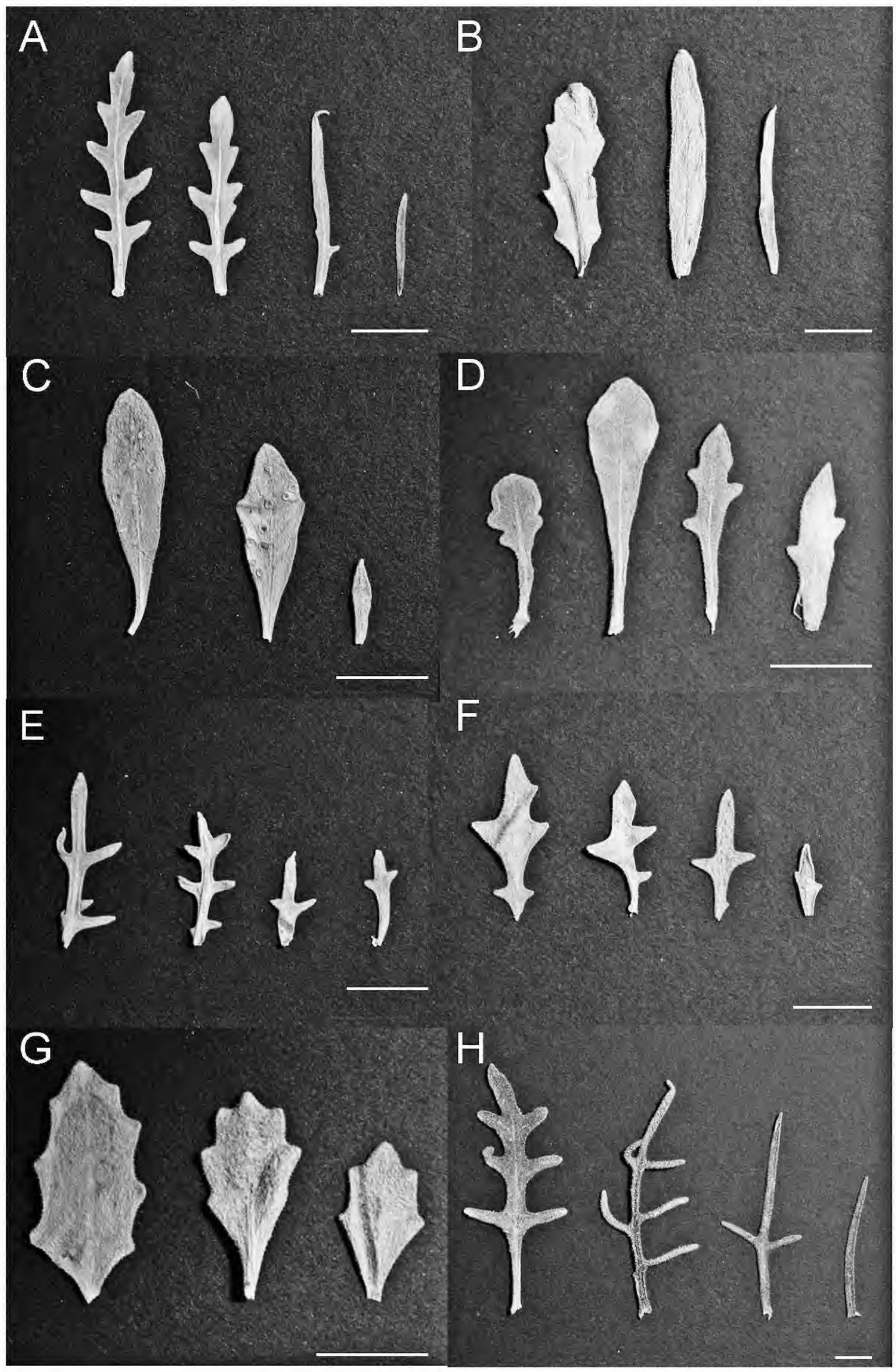

Figure 1. Leaves of species in the *Mentzelia multicaulis* complex. Leaf forms vary over the length of shoot systems and leaves from the basal, mid, and distal portions of shoots are shown (left to right, respectively). —A. *Mentzelia multicaulis* (U.S.A., Colorado, *J. Schenk 1878*, WS). —B. *M. rhizomata* (U.S.A., Colorado, *Hufford 4135*, WS). —C. *M. argillosa* (U.S.A., Utah, *Schenk 1746*, WS). —D. *M. argillicola* (U.S.A., Nevada, *Schenk 1192*, WS). —E. *M. flumensevera* (U.S.A., Utah, *Schenk 1745*, WS). —F. *M. librina* (U.S.A., Utah, *Schenk 1865*, WS). —G. *M. shultziorum* (U.S.A., Utah, *Hufford 4140*, WS). —H. *M. uintahensis* (U.S.A., Utah, *Schenk 1532*, WS). Scale bars = 1 cm.

Holmgren 14460 (NY, RENO, UTC, WS); along Hwy. 89, 3.4 mi. N of jct. of Bullion Ave. & Hwy. 89 in Marysvale, *L. Hufford 4147* (WS); Hwy. 89, 3.4 mi. N of Marysvale in small ravine on W side of rd., *J. Schenk 1744* (WS).

3. Mentzelia librina (K. H. Thorne & F. J. Smith) J. J. Schenk & L. Hufford, stat. nov. Basionym: *Mentzelia multicaulis* (Osterhout) J. Darlington var. *librina* K. H. Thorne & F. J. Smith, Great Basin Naturalist 46: 556. 1986. TYPE: U.S.A. Utah: Emery Co., T16S, R14E, S05, NE 1/4, SE 1/4, Book Cliffs, Horse Canyon, ca. 0.4 km on rd. to cliff base, SW aspect, 1890 m, 18 Aug. 1985, *F. J. Smith 2702* [F. J. Smith collection 2700 distributed as type] (holotype, BRY; isotypes, NY, OSC, RENO, RM, UTC).

Distribution and habitat. *Mentzelia librina* is a narrowly distributed endemic of the Book Cliffs in Emery and Carbon counties, Utah, at 1700–2000 m elevation.

Relationships. *Mentzelia librina* is most closely related to *M. shultziorum*, which is found south of the Book Cliffs near the Colorado River on steep slopes that rise to the La Sal Mountains in Grand County, Utah. The monophyly of the two species is strongly supported by DNA sequence data (Schenk & Hufford, in prep.). The median antesepalous stamens of *M. librina* are obovate and taper abruptly to a basal claw; these are similar to those of *M. shultziorum*, although the latter have a broader claw. The leaves of *M. librina* differ from the other varieties of *M. multicaulis* by having a broader rachis with long dentate lobes (Fig. 1F). The leaves of *M. shultziorum* are much broader than *M. librina*, with ovate to obovate laminas and dentate margins (Fig. 1G).

Additional specimens examined. U.S.A. **Utah:** Emery Co., at base of Book Cliffs just N of mouth of Horse Canyon, 0.8 km NW of where State Rte. 124 terminates, along abandoned railroad tracks, 10 km air distance SSE of Dragerton, *N. H. Holmgren & P. K. Holmgren 14462* (NY, RENO, UNLV, UTC, WS); just S of Columbia & below railroad grade, *J. Anderson 85-124* (UTC); CC Summerville, 13 mi. NNW from Green River, Beckwith Plateau, *S. Welsh & K. Taylor 15218* (NY). Carbon Co., E of unimproved rd. located NE of mile marker 2 on Rte. 124, SE of East Carbon City, below abandoned railroad, *J. Schenk 1865* (WS).

4. **Mentzelia uintahensis** (N. H. Holmgren & P. K. Holmgren) J. J. Schenk & L. Hufford, stat. nov. Basionym: *Mentzelia multicaulis* (Osterhout) J. Darlington var. *uintahensis* N. H. Holmgren & P. K. Holmgren, Syst. Bot. 27: 758. 2002. TYPE: U.S.A. Utah: Uintah Co., Uinta Basin, Watson-Rainbow Rd., 2.3 km SE of State Rte. 45 & 1.1 km E of Evacuation Creek bridge, 63 km air distance SE of downtown Vernal, 1600 m, 13 July 2001, *N. H. Holmgren & P. K. Holmgren 14465* (holotype, NY; isotypes, ARIZ, BRY, COLO, ID, NY, RENO, RM, UTC, WS).

Distribution and habitat. *Mentzelia uintahensis* is among the most widely distributed of the aforementioned species, occurring on the Colorado Plateau from Carbon, Duchesne, and Uintah counties, Utah, east to Rio Blanco, Grand, Mesa, and Moffat counties, Colorado. Individuals occur mostly on rocky cliffs or road-cuts of white shale or loose talus at 1575–2750 m elevation. Its location and habitats are generally continuous with those of *M. librina*, and *M. uintahensis* is sister to the clade consisting of *M. librina* and *M. shultziorum*.

Relationships. The median antesepalous stamens of *Mentzelia uintahensis* are flabellate and have bases that narrow abruptly to a claw, which also characterizes the median antesepalous stamens of *M. librina* and *M. shultziorum*, although in the latter the claws are not as prominently narrowed. The basal leaves of *M. uintahensis* (Fig. 1H) are larger than those of the other species discussed here and have pinnate lobes that are much longer than those of *M. flumensevera* or *M. shultziorum*.

Additional specimens examined. U.S.A. **Colorado:** Rio Blanco Co., Piceance Creek Rd., at mouth of Cascade Gulch, 16.9 km NW of Rio Blanco, *N. H. Holmgren & P. K. Holmgren 14482* (NY, UTC); Piceance Creek Rd., 5.5 km S of State Rte. 64, *N. H. Holmgren & P. K. Holmgren 14475* (NY, UTC); Piceance Creek Rd., 15.1 km S of State Rte. 64, *N. H. Holmgren & P. K. Holmgren 14476* (NY, UTC, WS); Piceance Creek Rd., across rd. from Piceance Creek Ranch, 18.3 km NW of Rio Blanco, *N. H. Holmgren & P. K. Holmgren 14480* (NY, UTC, WS); Piceance Creek Rd., ca. 9 mi. below Rio Blanco, *W. A. Weber 17809* (UTC); 11 mi. W of Rio Blanco on Piceance Creek, *T. Beegle 766* (UTC); Piceance Creek near mouth of Cascade Gulch, Hwy. 26, *S. Goodrich 23158* (NY, UTC); on a road-cut along Co. Rd. 122 just W of jct. w/Co. Rd. 24, *P. Lyon 9176* (NY); Story Gulch, 0.3 mi. SE of Piceance Creek Ranch, *J. Walker & S. Sigstedt 82-334* (NY); along Piceance Creek Rd., 9.5 mi. NW of jct. w/Hwy. 13 at Rio Blanco, *L. Hufford 4137* (WS); W of Rio Blanco, Piceance Creek Rd., 6 mi. W from its intersection w/ Rte. 13, *J. Schenk 961* (WS). Moffat Co., 1/2 mi. up the Yampa River from confluence of Green & Yampa Rivers in Echo Park, *N. H. Holmgren et al. 469* (NY, UTC). Mesa Co., Grand Junction, May 1892, *A. Eastwood* (NY), *M. E. Jones 5472* (NY). Grand Co., 1 mi. E of Hot Sulphur Springs, *H. D. Ripley & R. C. Barneby 10504* (NY). **Utah:** Carbon Co., 1.6 mi. NE of Mt. Bartles Summit, S of Nine Mile Canyon, *E. Neese & L. England 6181a* (BRY). Uintah Co., 14 mi. due S of Ouray, *S. Welsh et al. 14395* (M, UTC); Split Mountain Gorge Campground, Dinosaur Natl. Monument, *K. S. Dever & R. A. Wolf 5280* (UTC); Ouray-Rainbow Rd., 37 mi. SE of Ouray at jct. of rd. along ridge betw. Sweetwater Canyon & Main Canyon, *N. H. Holmgren et al. 2270* (ID, NY, UTC); Klondike Canyon, *J. S. Peterson 1470* (NY, UTC); above Green River, E from Sand Wash Ferry, 6 mi. W of Wrinkles Rd., *L. M. Shultz & J. S. Shultz 3798* (NY, UTC); Southam Canyon Quadrangle, 30 July 1975, *J. Baker* (UTC); Uinta Basin, rd. from Bonanza to Watson, 1 km E of Evacuation Creek bridge, *N. H. Holmgren & P. K. Holmgren 14608* (NY, UTC); Uinta Basin, Watson-Rainbow Rd., 0.5 km S of State Rte. 45 & 0.6 km N of Evacuation Creek bridge, 62.5 km air distance SE of downtown Vernal, *N. H. Holmgren & P. K. Holmgren 14466* (NY, UTC, WS); Uinta Basin, 6.5 km air distance SSE of Bonanza, overlooking confluence of Evacuation Creek & White River, *N. H. Holmgren & P. K. Holmgren 14492* (ID, NY, RENO, UNLV, UTC, WS); Dugway in upper Three Mile Canyon, W of Evacuation Creek, Book Cliffs, *N. D. Atwood 30480* (RENO); Hell's Hole Canyon, SE of Bonanza, *N. D. Atwood 20471* (RENO); E Tavaputs Plateau, Big Pack, Little Pack Mtn., 24 mi. & 185 degrees from Ouray, *S. Goodrich & D. Atwood 14686* (NY); ca. 4 mi. W of Maeser, along Utah Hwy. 245, *S. L. Welsh & G. Moore 6750* (NY); Hell's Hole Canyon, 1.5 mi. W of Colorado–Utah border, *K. Thorne & B. Neely 1935* (NY); E base of Blue Mtn., head of Cub Creek, *E. Neese & C. Fullmer*

11750 (NY); Uinta Basin, rd. into Hell's Hole Canyon, 1.4 km down rd. from Bonanza-Watson rd., 9.5 km air distance SE of Bonanza, *N. H. Holmgren & P. K. Holmgren 14495* (NY); clay hills by Thorne Ranch, Willow Creek, *N. D. Atwood 1564* (NY); on white shale banks along Evacuation Creek 2 mi. S of White River, *H. D. Ripley & R. C. Barneby 8735* (NY); 15 mi. S of Bonanza & 1.3 mi. W of Colorado border, *E. Neese et al. 11659* (NY); Weaver Ridge E of White River, *N. D. Atwood 30475a* (NY, UNM); Hell's Hole Canyon, SE of Bonanza, *N. D. Atwood 30471* (NY); 37 mi. S of Ouray, *R. C. Barneby 13155* (NY); W of Vernal, Rte. 121, 7.9 mi. W of intersection w/Hwy. 191, *J. Schenk 1526* (WS). Duchesne Co., 3.5 mi. N of Nine Mile Canyon jct. w/Myton Rd., thence ca. 20 mi. E on dirt rd., *N. D. Atwood 2665* (NY); W Tavaputs Plateau, Wrinkle Rd., 11.7 km E of Myton-Wellington rd., 40 km air distance SSW of Myton, *N. H. Holmgren & P. K. Holmgren 13233* (NY).

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Two New Species of *Bulbophyllum* (Orchidaceae) from Brazil

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Abstract. Two new species of *Bulbophyllum* Thouars (Orchidaceae) from Brazil belonging to section *Xiphizusa* (Reichenbach f.) Cogniaux are described and illustrated. Both species are epiphytic, but grow in different vegetational types. *Bulbophyllum gehrtii* E. C. Smidt & Borba is native to cerrado vegetation in São Paulo and Minas Gerais states and is related to *B. plumosum* (Barbosa Rodrigues) Cogniaux, while *B. teimosense* E. C. Smidt & Borba grows in the Atlantic rainforest in southeastern Bahia State and is related to *B. chloropterum* Reichenbach f. According to IUCN Red List criteria, *B. gehrtii* is categorized as Endangered and *B. teimosense* as Critically Endangered.

Key words: Atlantic rainforest, Brazil, *Bulbophyllum*, IUCN Red List, Orchidaceae.

The pantropical *Bulbophyllum* Thouars is the largest orchid genus, including over 1000 species (Vermeulen, 1991; Dressler, 1993). The large majority of species occurs in the Old World, mainly in southeastern Asia, and nearly 70 species are present in the Neotropics. In the most recent checklist for Brazilian orchids, Pabst and Dungs (1975) cited 54 species for Brazil. However, with the addition of recently described species and new occurrences for this country (e.g., Borba et al., 1998; Fraga, 1999, 2004; Toscano de Brito, 2000; Borba & Smidt, 2004; Fraga & Smidt, 2004; Ribeiro et al., 2005), this number has increased to about 65.

The Neotropical *Bulbophyllum* sect. *Xiphizusa* (Reichenbach f.) Cogniaux comprises about 25 species and is characterized mainly by the small discoid, compressed, aggregated, monophyllous pseudobulbs; the long scape with the flowers arranged distichously on a thin rachis; the presence of a conspicuous jugae (extension of the ovary tissue) at the petal base; long fused lateral sepals forming a synsepal in most species; and the petals oblong to narrowly lanceolate and pilose in most species, with long hairs along the petal margins. In addition, the lip is trilobed; the lateral lobes are erect, obtuse, and sometimes pilose; and the disc is smooth or presents a longitudinal ridge at the middle. For convenience, the lip is sometimes described in two parts: a basal portion called the hypochile, which possesses the lateral lobes and the disc, and the upper portion, known as the epichile. The epichile may be thin and membranaceous or somewhat thick, and in some species it is sessile or more usually constricted; the limb may be flat or concave, and is usually smooth or rarely ciliate in the margin and the face. The column has two long arms at the apex and two small teeth on the adaxial margins.

The species of *Bulbophyllum* sect. *Xiphizusa* are generally epiphytic in forest and cerrado areas. They are occasionally lithophytic in campo rupestre vegetation (e.g., *B. plumosum* (Barbosa Rodrigues) Cogniaux and *B. bidentatum* (Barbosa Rodrigues) Cogniaux). The campo rupestre vegetation of the Espinhaço Range in southeastern Brazil is the main center of species diversity for *Bulbophyllum* sect. *Xiphizusa* (Smidt & Borba, 2007; Smidt et al., 2007), but the section has a disjunct distribution between southeastern Brazil and the northern Andes, with one species in Jamaica. In the course of a revision of the Neotropical *Bulbophyllum* species, we found two new species belonging to section *Xiphizusa*.

1. Bulbophyllum gehrtii E. C. Smidt & Borba, sp. nov. TYPE: Brazil. São Paulo: São Paulo, Cidade Jardim, 23°32′S, 46°38′W, 23 May 1930 (fl.), *A. Gehrt s.n.* (holotype, SP 27855). Figure 1.

Haec species *Bulbophyllo plumoso* (Barbosa Rodrigues) Cogniaux similis, sed labello hypochilo pubescente non nisi ad apicem crista inter lobos lateralis laevi et foliis linearibus differt.

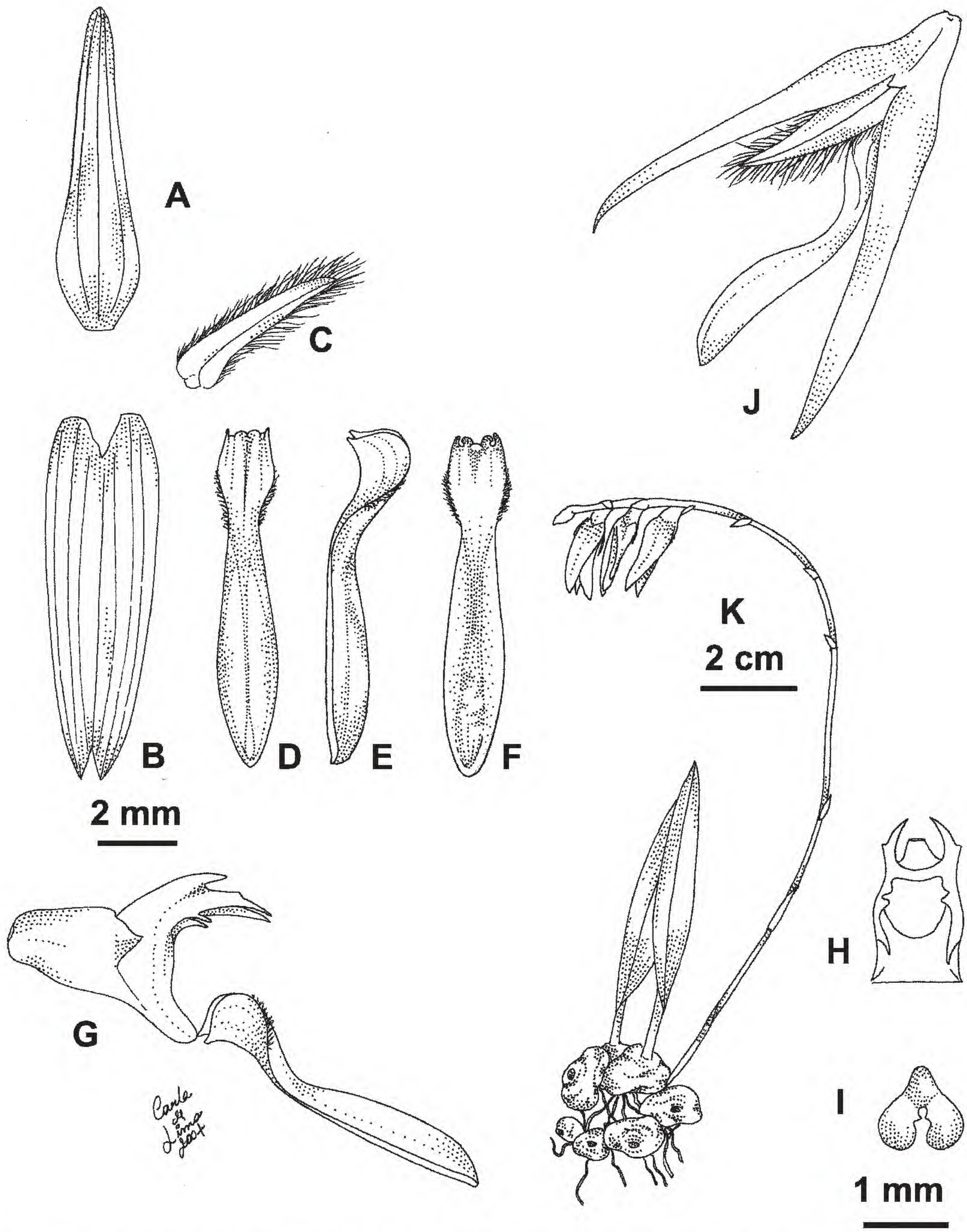

Figure 1. *Bulbophyllum gehrtii* E. C. Smidt & Borba. —A. Dorsal sepal. —B. Fused lateral sepals. —C. Petal. —D. Lip, upper view. —E. Lip, side view. —F. Lip, lower view. —G. Lip and column, side view. —H. Column, lower view. —I. Anther. —J. Flower, side view. —K. Habit. Scale bars: A–G, J = 2 mm; H, I = 1 mm; K = 2 cm. Drawn from the holotype, *A. Gehrt, s.n.* (SP 27855), by Carla de Lima.

Mostly epiphytic herbs; rhizome inconspicuous; pseudobulbs ca. 0.7 × 0.7 cm, deltoid, transversely elliptic, green, rugose, monophyllous. Leaves 4.5–6 × 0.2–0.3 cm, linear, plane, base constricted, apex acute, coriaceous. Inflorescence a raceme to 10 cm, erect, scape cylindrical, basal bract of the scape inconspicuous, the others not imbricate; bracts of the rachis sessile, not imbricate; rachis 1–2 cm, pendulous, thin, 3 to 5 flowers arranged distichously, anthesis simultaneous. Flowers pendent, membrana-

ceous, jugae present and conspicuous; sepals erect, smooth, brown; dorsal sepal ca. 9 × 2 mm, lanceolate, plane, 3-nerved, margin glabrous, base dilated, apex acuminate; lateral sepals ca. 9 × 3 mm, lanceolate, fused from base to near the apex, 3-nerved, margin glabrous, apex acute; petals ca. 4 × 0.8 mm, lanceolate, slightly falcate, erect, plane, 1-nerved, base sessile, apex acute, margin ciliate with long purple hairs, whitish, translucent, midvein purple; lip ca. 9 × 1 mm, trilobed, differentiated as epichile and hypochile; hypochile with lateral lobes erect, obtuse, pubescent on the distal half, apex attenuate, disc between the lateral lobes with a smooth discrete ridge; epichile membranaceous, concave, lanceolate, margin glabrous, base constricted, apex acute, mostly brown with purple dots; column glabrous adaxially; stellidia present, erect, entire, apex acute; teeth present, erect, apex acute; column foot short, stigma large; anther incumbent. Fruit not seen.

Distribution and habitat. *Bulbophyllum gehrtii* grows as an epiphyte on cerrado vegetation. The two known collections for this species were found ca. 300 km apart. Within this area, there is a vegetation mosaic of cerrado, Atlantic rainforest, and campo rupestre, where it is possible to find the majority of the Brazilian species of *Bulbophyllum* (Smidt & Borba, 2007).

IUCN Red List category. Because the new species is known only from two Brazilian collections from two of the most extensively sampled areas in Minas Gerais and São Paulo states, with extent of occurrence estimated to be less than 5000 km^2, its conservation status must be considered as Endangered (EN B1ab[iii]) according to IUCN Red List criteria (IUCN, 2001). The species appears to be endemic to those areas of cerrado vegetation, which is one of the most deforested biomes in the past decades due to implementation of pastures and soybean plantations (Klink & Machado, 2005).

Etymology. This species is named in honor of Augusto Gehrt, who collected the holotype material. Gehrt was one of the main field assistants of Frederico Carlos Hoehne at the inception of the Instituto de Botânica de São Paulo (IBt-SP). He accompanied Hoehne on his initial field trips, mainly in São Paulo State and adjacent regions. Because of Hoehne, Gehrt, and Oswaldo Handro (another important collector at the beginning of the IBt-SP), we know about the orchid species that occurred in important regions of São Paulo State, such as the margins of the Tietê and Pinheiros rivers, which are now unfortunately entirely urban areas.

Relationships. *Bulbophyllum gehrtii* is closely related to *B. plumosum*, differing by having short hairs only on the distal part of the hypochile, by the disc with a smooth ridge, and by the linear leaves. In contrast, *B. plumosum* has a lip with a densely hairy hypochile throughout, a disc possessing a deep ridge with transverse ribs inside, and oblong to widely lanceolate leaves. In addition, the epichile of *B. gehrtii* is concave with an obtuse and entire apex versus plane with an emarginated or occasionally entire apex in *B. plumosum*.

Paratype. BRAZIL. **Minas Gerais:** Carrancas, 16°33′S, 42°54′W, Apr. 2000 (fl.), *E. L. Borba s.n.* (HUEFS 116101).

2. Bulbophyllum teimosense E. C. Smidt & Borba, sp. nov. TYPE: Brazil. Bahia: Jussari, RPPN Serra do Teimoso, 15°11′S, 39°29′W, Mar. 2003 (fl.), *E. C. Smidt & E. L. Borba 308* (holotype, HUEFS). Figure 2.

Species haec *Bulbophyllo chloroptero* Reichenbach f. similis, sed labello hypochilo piloso et floribus minoribus brunneis differt.

Mostly epiphytic herbs; rhizome inconspicuous; pseudobulbs 0.7–1 × 0.9–1 cm, deltoid, transversely elliptic, green, smooth, monophyllous. Leaves 2–4 × 0.4–0.6 cm, elliptic, plane, base constricted, apex acute, coriaceous. Inflorescence a raceme to 15 cm, erect, scape cylindrical, basal bract of the scape inconspicuous, the others not imbricate; bracts of the rachis sessile, not imbricate; rachis ca. 6 cm, pendulous, thin, ca. 10 flowers arranged distichously, anthesis simultaneous. Flowers pendent, membranaceous, jugae present and conspicuous; sepals erect, smooth, brown, margin glabrous, apex acute; dorsal sepal ca. 13 × 3 mm, lanceolate, plane, 3-nerved; lateral sepals ca. 14 × 3.5 mm, lanceolate, fused from base to near the apex, 3-nerved; petals ca. 5 × 2 mm, lanceolate, erect, plane, 1-nerved, base sessile, apex acute, margin ciliate with long hairs, brown, translucent, midvein purple; lip 10–12 × 1–1.5 mm, trilobed, differentiated as epichile and hypochile; hypochile with lateral lobes erect, obtuse, pilose; disc extending beyond the lateral lobes nearly to the middle of the lip, apex attenuate, disc with a smooth ridge, conspicuous; epichile membranaceous, plane, lanceolate, margin glabrous, base constricted, apex acuminate, mostly brown with purple dots; column glabrous adaxially; stellidia present, bidentate, erect, apex acute; teeth present, apex entire; column foot short, stigma large; anther incumbent. Fruit not seen.

Distribution and habitat. *Bulbophyllum teimosense* grows in areas of native and well-preserved Atlantic rainforest, as epiphytes in the forest canopy.

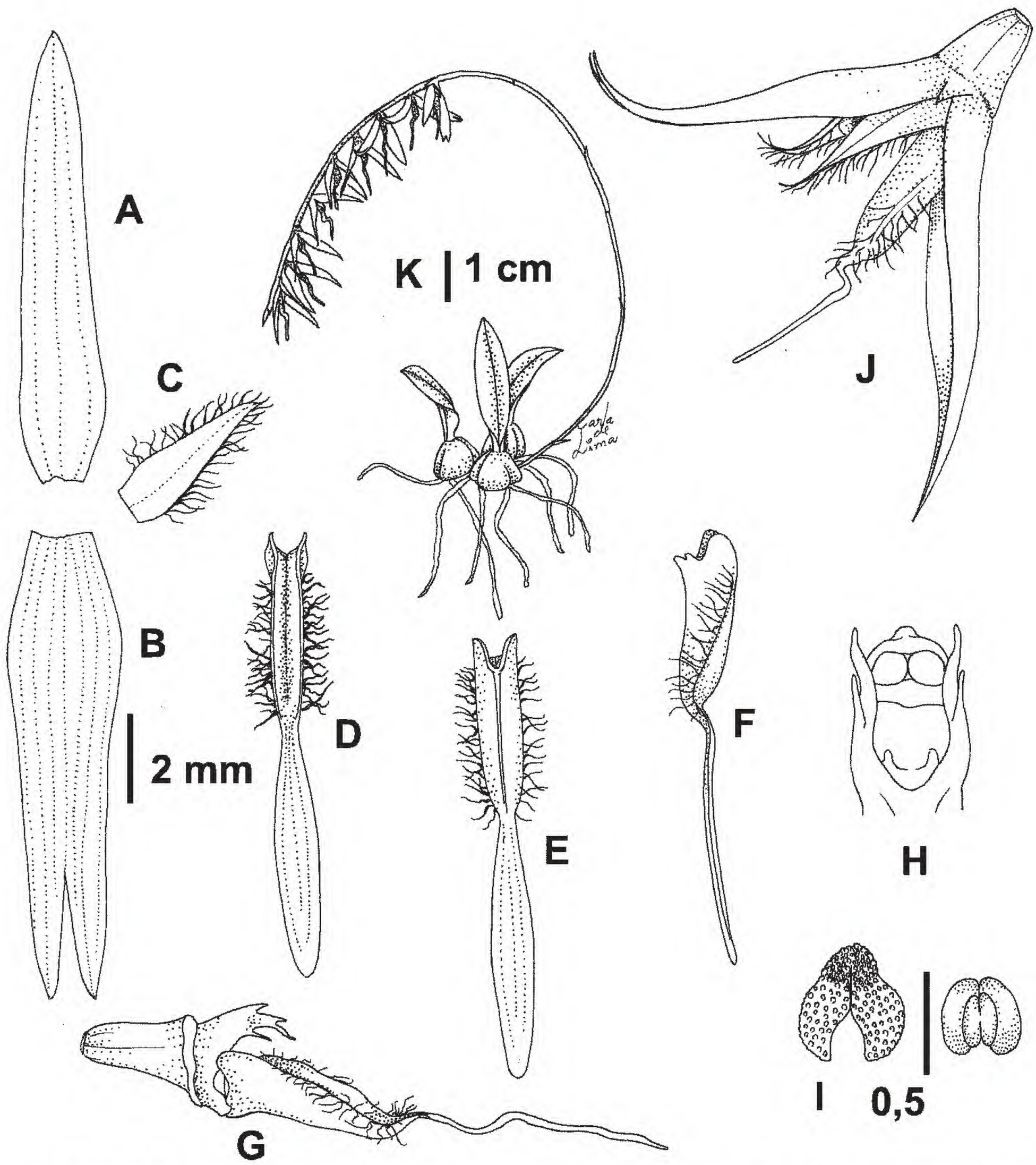

Figure 2. *Bulbophyllum teimosense* E. C. Smidt & Borba. —A. Dorsal sepal. —B. Fused lateral sepals. —C. Petal. —D. Lip, upper view. —E. Lip, lower view. —F. Lip, side view. —G. Lip and column, side view. —H. Column, lower view. —I. Anther and pollinarium. —J. Flower, side view. —K. Habit. Scale bars: A–G, J = 2 mm; H, I = 0.5 mm; K = 1 cm. Drawn from the holotype, *E. C. Smidt & E. L. Borba 308* (HUEFS), by Carla de Lima.

It is the only species from *Bulbophyllum* sect. *Xiphizusa* found so far in areas of Atlantic rainforest s. str.; the remaining species occur in gallery forests, cerrado, and campo rupestre vegetation.

IUCN Red List category. Because the new species is known only from the type material, which is from a well-collected region in Bahia State, its conservation status must be considered as Vulnerable (V B1ab[iii]) according to IUCN Red List criteria (IUCN, 2001). Furthermore, this species is microendemic to the Atlantic rainforest, one of the most endangered biomes in Brazil since the colonization of the country, which is currently reduced to 7% of its original area. This particular region of Atlantic rainforest in southern Bahia is considered one of the principal Brazilian hot spots, presenting high endemism (Mori et al., 1983; Thomas et al., 1998).

Etymology. The new species is named after the Reserva Particular do Patrimônio Natural (RPPN) Serra do Teimoso, in the municipality of Jussari in the southernmost part of Bahia State, where it was found.

Relationships. Bulbophyllum teimosense is the second species known in which the disc in the

hypochile extends as far as to the middle of the lip. In all other species of *Bulbophyllum* sect. *Xiphizusa*, in which the lip is clearly differentiated as hypochile and epichile, the disc is located only between the lateral lobes. *Bulbophyllum chloropterum* is the one other species with this characteristic. This species was described by Reichenbach f. in 1849 from a plant discovered by Hoffmannsegg in Rio de Janeiro State, of uncertain locality and indicated only as received from the Orquidário Binot. Recently, Ribeiro et al. (2005) and Toscano and Cribb (2006) reported the occurrence of *B. chloropterum* in the Chapada Diamantina, in central Bahia, growing as epiphytic and rupicolous plants in areas of campo rupestre. The sepals of *B. chloropterum* are green on the outer margins and brown inside, with a purple lip and smooth hypochile, while *B. teimosense* has brown flowers with a brown, purple-spotted lip and a densely pilose hypochile.

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About the Typification of *Myriophyllum aquaticum* (Haloragaceae)

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Abstract. In 1973, Verdcourt made the combination in *Myriophyllum* L.: *M. aquaticum* (Vellozo) Verdcourt based on *Enydria aquatica* Vellozo in the Haloragaceae. However, significant morphological differences exist between the study of the Vellozo 1825 protologue and the Vellozo 1831 plate of *E. aquatica*. Therefore, we propose the designation of an epitype to better fix the taxonomic application of the name *M. aquaticum* (Vellozo) Verdcourt.

Resumen. En 1973, Verdcourt realizó una nueva combinación en *Myriophyllum* L.: *M. aquaticum* (Vellozo) Verdcourt basándose en *Enydria aquatica* Vellozo. A través del estudio de la descripción original (1825) y lámina (1831) de *E. aquatica*, encontramos que los caracteres diagnósticos son diferentes. Por lo tanto en el presente trabajo se propone designar un epitipo para *M. aquaticum* (Vellozo) Verdcourt para la mejor aplicación del nombre.

Key words: *Enydria*, Haloragaceae, *Myriophyllum*.

The name *Myriophyllum brasiliense* Cambessèdes (Haloragaceae), described in 1830 (Cambessèdes, 1830), was applied to a species native to South America from Argentina, Brazil, Chile, Paraguay, Peru, and Uruguay (Meijden & Caspers, 1971; Boutique & Verdcourt, 1973; Ayres Fevereiro, 1975; Orchard, 1979, 1981; Li & Hsieh, 1996; Negritto & Anton, 1996; Zuloaga & Morrone, 1999). However, this aquatic species has become almost cosmopolitan in distribution, growing as an adventitious plant in temperate and tropical regions of the world, where it was at least initially cultivated as an ornamental plant. *Myriophyllum brasiliense* is commonly found in freshwater bodies, where it grows in shallow quiet water, usually associated with other free-emergent floating species.

Until 1973, this aquatic plant taxon was known by the name *Myriophyllum brasiliense*, but as a result of Verdcourt's (1973) identification of the Vellozo (1827 [1831]) plate of *Enydria aquatica* Vellozo (1825 [1829]), the combined name *M. aquaticum* (Vellozo) Verdcourt has been applied to this species since then. Although some plant material may have been available to Vellozo, there are no surviving herbarium specimens of *E. aquatica*, and we have only the original description and plate for the interpretation of this name. Although the plate was not published until later in 1831, it was cited in Vellozo's protologue (1825 [1829]). The plate clearly represents original material (Art. 9.2 of the *International Code of Botanical Nomenclature* [McNeill et al., 2006]) and constitutes the only available element for lectotypification, and was so designated by Orchard (1979). In the *Flora of Tropical East Africa*, published in the same year as the new combination (Verdcourt, 1973), Boutique and Verdcourt (1973: 7) cited the type locality of *M. aquaticum* as "Brazil, junction of R. Taguahy and R. Amazon." However, the actual locality is "... fluvium Taguahy confluentium sub aquis" (Vellozo, 1825 [1829]: 57), which is near Rio de Janeiro.

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Figure 1. Photo of the epitype of *Myriophyllum aquaticum* (Vellozo) Verdcourt (*O. C. Gões 863*, RB).

We have examined and compared the plate and the original description of *Enydria aquatica*, and there are significant differences between the plant described (1825 [1829]) and the plant illustrated (1827 [1831]) by Vellozo, with respect to reproductive and vegetative characters. The description (Vellozo, 1825 [1829]: 57) of the genus *Enydria* and its single species *E. aquatica* mentioned the solitary axillary flowers, four stamens with acuminate anthers, and the absence of evident styles, as well as tuberous roots,

branched stems, and opposite leaves. In contrast, the species represented by the plate (1827 [1831]) designated as the lectotype has whorled axillary flowers, eight stamens with linear-lanceolate anthers, and four evident styles, with fasciculate roots, few-branched stems, and (4)5(6) whorled leaves. Although the reported style difference could be discounted, since from his comment it is uncertain whether female flowers were actually observed by Vellozo, characters such as tuberous roots and opposite leaves are not present in *M. aquaticum*, even under extreme environmental conditions (e.g., sandy soils, desiccated ponds).

The poor incongruence of the plate and description suggest significant characters were wrongly portrayed for the plant in question, *Myriophyllum aquaticum*. Therefore, its lectotype is demonstrably ambiguous and cannot be critically identified for purposes of the precise application of the name. Therefore, we apply Article 9.7 of the ICBN (McNeil et al., 2006), and our selection of an epitype for *Enydria aquatica* serves to fix the application of this name in accordance with its current usage.

Myriophyllum aquaticum (Vellozo) Verdcourt, Kew Bull. 28: 36. 1973. *Enydria aquatica* Vellozo, Fl. Flumin. 57. 1825 [1829]. TYPE: Brazil. Rio de Janeiro: "Offendi rivulo quodam ad fluvium Taguahy confluentium sub aquis," *Vellozo s.n.* (lectotype, Fl. Flumin. Icon. 1, tab. 150, 1831. *Vellozo s.n.*, designated by Orchard, 1979: 249). EPITYPE: Brazil. Rio de Janeiro: Petrópolis, Caelitu, Dec. 1943, *O. C. Gões 863* (epitype, designated here, RB). Figure 1.

Myriophyllum brasiliense Cambessèdes, Fl. Bras. Merid. 2: 252. 1829 [1830]. TYPE: Brazil. "In paludibus prope Jondiahi haud longe ab urbe S. Pauli. Florebat Octobri," *A. St. Hilaire 1082* (holotype, MPU [digital image seen]; isotype, P not seen).

Myriophyllum proserpinacoides Gillies ex Hooker & Arnott, Bot. Misc. 3: 313. 1833. TYPE: Argentina. "Ditches at Buenos Ayres," s.d., *Dr. Gillies s.n.* (lectotype, designated by Orchard, 1979: 250, K [digital image seen]).

The lectotype of *M. proserpinacoides* was designated by Mora in sched. in 1970, but this was not published. Later, Orchard (1979) mentioned that the lectotype was designated by Mora. Thus, we consider this 1979 publication as the effective designation of the lectotype.

There were some materials cited by Gillies (1833) in the original description. These materials were cited as syntypes of *M. proserpinacoides* by Orchard (1979) and previously cited as paratypes by Mora in sched. in 1970.

Specimens examined. ARGENTINA. **Buenos Aires:** "La Plata, B. Ayres," s.d., *Tweedie s.n.* (syntype, *Myriophyllum proserpinacoides*, K [digital image seen]). CHILE. "Andes of Chili," s.d., *Cuming 164* (syntype, *M. proserpinacoides*, K [digital image seen]).

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Nomenclatural Corrections in Onagraceae

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Abstract. In this paper, we provide corrections to a recent synoptical revision of the family Onagraceae (Wagner et al., 2007). The first valid publication of subfamily Onagroideae was in 1834 by Eaton, and not in 2007 by Wagner et al. We correct the authorship and place of publication of *Camissonia contorta* (Douglas) P. H. Raven, *Chylismia scapoidea* (Torrey & A. Gray) Nuttall ex Raimann, and *Camissonia chamaenerioides* (A. Gray) P. H. Raven. We correct the authorship and typification of *Oenothera suffulta* (Engelmann ex A. Gray) W. L. Wagner & Hoch, as well as the typification of *Chylismia claviformis* subsp. *lancifolia* (A. Heller) W. L. Wagner & Hoch. Our new genus *Holmgrenia* W. L. Wagner & Hoch is a later homonym of a name validly published by S. O. Lindberg in 1863. We propose the replacement name of *Neoholmgrenia* W. L. Wagner & Hoch to correct this problem, and make the two species-level combinations, *N. andina* (Nuttall) W. L. Wagner & Hoch, and *N. hilgardii* (Greene) W. L. Wagner & Hoch.

Key words: Camissonia, Chylismia, Neoholmgrenia, Oenothera, Onagraceae, Onagroideae.

Following the publication of our synoptical revision of the classification of Onagraceae (Wagner et al., 2007), we or others have noted several problems that we will correct here.

Subfamily Name

We published the name Onagraceae subfam. Onagroideae as new (Wagner et al., 2007: 41, 238) because we were not aware of any previous valid publication of this name. As we prepared our synopsis, we consulted Jim Reveal's website (<http://www.plantsystematics.org/reveal/pbio/fam/sgindex.html>, Reveal, 2003) because it represents the only compilation of suprageneric names available. Reveal listed the earliest publication for this subfamily as: "subfam. Onagroideae Lindley in Beilschmied, Flora (Bieb.) 16(2): 58, 109. 14 Jun 1833 (Onagridae)." Our examination of copies of this publication in the libraries of MO and US revealed confusing discrepancies: the MO copy of *Flora* 16(2) does not include the Beilschmied article at all, whereas the US copy does, but with different pagination than that reported by Reveal (the relevant page in the US copy was p. 96, not 58). The MO library does, however, include another publication by Beilschmied from the same year, entitled *John Lindley's...Characteres distinctivi oder Hauptkennzeichen der naturlichen Pflanzenfamilien* (reported in TL2: 4644), which is a verbatim copy of the *Flora* article as it appears in the US copy, albeit with different pagination. After careful examination of these publications with their conflicting paginations, however, we disagreed with Reveal, and concluded that Beilschmied, who was translating and extracting Lindley's (1830) *An Introduction to the Natural System of Botany* for a German-speaking audience, did not recognize subfamilies as such and did not substantively modify Lindley's treatment, which explicitly accepted de Candolle's (1828) tribal classification of Onagraceae. The only deviation from de Candolle adopted by Lindley was the recognition of Circaeaceae as a separate family, a classification also followed by Beilschmied.

On his website, Reveal also reported two other possibly relevant subfamilial names: subfamily Oenotheroideae Kosteletsky (Kosteletsky, 1835, as Oenothereae), and subfamily Circaeoideae Kosteletsky (Kosteletsky, 1835, as Circaeeae). In this instance, we again disagree with Reveal's interpretation. Kosteletzky, like Lindley and many other authors of that period, adopted de Candolle's classification of Onagraceae with five tribes, using the same tribal Latin endings (McNeill et al., 2006), with only minor changes: Kosteletzky called his taxa Gruppen, and changed one from de Candolle's Onagreae to Oenothereae. We find no direct evidence that Kosteletzky intended to change these Candollean tribes into subfamilies.

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Discussion with Reveal (pers. comm. in 2007 after publication of our synopsis) revealed other valid publications of subfamily Onagroideae prior to our synopsis in 2007, the earliest of which appears to be:

Onagraceae subfam. **Onagroideae** Eaton, Bot. Dict., ed. 4: 44. 1836. TYPE: *Onagra* Miller [= *Oenothera* L.].

Attribution of Species Names

In his revision of *Camissonia* Link, Raven (1969) considered the new combination bringing *Oenothera contorta* Douglas into *Camissonia* to have been made by Kearney (in Britton & Kearney, 1894: 37), and we (Wagner et al., 2007: 122) repeated this information in citation. Our subsequent examination of Britton and Kearney's publication shows that Kearney did not validly make this combination, since he provided only an unranked trinomial *Chamissonia contorta pubens* based on *Oenothera contorta pubens*. Therefore, the next available and correct author and place of publication is Raven (1969), with the name appropriately attributed as *C. contorta* (Douglas) P. H. Raven.

Similarly, we listed Small (1896) as the author of the combination *Chylismia scapoidea*, following Raven (1962, 1969); however, this combination was originally made three years earlier in Raimann (1893). The correct author and place of publication is Raimann (1893: 217). The name should be appropriately attributed as *C. scapoidea* (Torrey & A. Gray) Nuttall ex Raimann in Wagner et al. (2007: 133, 136).

We inadvertently overlooked a correction in Raven (1982) relevant to the first valid publication of the combination *Camissonia chamaenerioides* (A. Gray) P. H. Raven. The correct place of publication is Raven (1982). The name is referred to *Eremothera chamaenerioides* (A. Gray) W. L. Wagner & Hoch, in Wagner et al. (2007: 127, 209).

Type Designations

We incorrectly selected a lectotype for *Chylismia lancifolia*, when in fact the holotype still exists, as pointed out to us by A. G. Tiehm (pers. comm.) after our synopsis appeared. Kerry Barringer kindly verified that the holotype is indeed extant in BKL. We also incorrectly typified *Oenothera suffulta* and misstated the authorship of this name, which was brought to our attention by Jim Zarucchi and Kanchi Gandhi. The corrections are as follows:

Chylismia claviformis subsp. **lancifolia** (A. Heller) W. L. Wagner & Hoch, Syst. Bot. Monogr. 83: 206. 2007. Basionym: *Chylismia lancifolia* A. Heller, Muhlenbergia 2: 226. 1906. *Oenothera claviformis* subsp. *lancifolia* (A. Heller) P. H. Raven, Univ. Calif. Publ. Bot. 34: 109. 1962. *Camissonia claviformis* subsp. *lancifolia* (A. Heller) P. H. Raven, Brittonia 16: 282. 1964. TYPE: U.S.A. California: Inyo Co., base of White Mtns. E of Laws, 11 May 1906, *A. Heller 8231* (holotype, BKL not seen; isotypes, CAS, COLO, DS not seen, MO, NY, UC not seen, US).

Oenothera suffulta (Engelmann ex A. Gray) W. L. Wagner & Hoch, Syst. Bot. Monogr. 83: 214. 2007. Basionym: *Gaura suffulta* Engelmann ex A. Gray, Bost. J. Nat. Hist. 6: 190. 1850. TYPE: U.S.A. Texas: Comal Co., New Braunfels, May 1847, *F. Lindheimer 611* (lectotype, designated by Raven & Gregory, 1972 [1973]: 80, GH not seen; duplicates [isolectotypes], BM not seen, F not seen, GH [3], LE not seen, M not seen, MO [3], NY, PH not seen, US).

New Generic Name

When we published the new genus *Holmgrenia* W. L. Wagner & Hoch, we were unaware of an earlier name *Holmgrenia* Lindberg (Lindberg, 1862), published for a genus of bryophytes that is now known by the conserved name *Orthothecium* Schimper (in Bruch et al., 1851). We here propose a new name for the western North American genus in Onagraceae, and make the two necessary species-level combinations.

Neoholmgrenia W. L. Wagner & Hoch, nom. nov. *Holmgrenia* W. L. Wagner & Hoch, Syst. Bot. Monogr. 83: 127. 2007, nom. illeg., non *Holmgrenia* Lindberg, 1863. TYPE: *Neoholmgrenia hilgardii* (Greene) W. L. Wagner & Hoch.

Camissonia sect. *Nematocaulis* P. H. Raven, Brittonia 16: 285. 1964. *Oenothera* sect. *Nematocaulis* (P. H. Raven) Munz, N. Amer. Fl., ser. 2, 5: 155. 1965. TYPE: *Oenothera hilgardii* Greene [= *Neoholmgrenia hilgardii* (Greene) W. L. Wagner & Hoch].

Neoholmgrenia andina (Nuttall) W. L. Wagner & Hoch, comb. nov. Basionym: *Oenothera andina* Nuttall, in Torrey & A. Gray, Fl. N. Amer. 1: 512. 1840. *Sphaerostigma andinum* (Nuttall) Walpers, Repert. Bot. Syst. 2: 79. 1843. *Camissonia andina* (Nuttall) P. H. Raven, Brittonia 16: 285. 1964. *Holmgrenia andina* (Nuttall) W. L. Wagner & Hoch, Syst. Bot. Monogr. 83: 210. 2007, nom. illeg. TYPE: U.S.A. Idaho: Bingham or Caribou Co., dry plains near the Blackfoot River, 10–12 July 1834, *T. Nuttall s.n.* (holotype, BM not seen; isotypes, GH, K, NY, PH not seen).

Neoholmgrenia hilgardii (Greene) W. L. Wagner & Hoch, comb. nov. Basionym: *Oenothera hilgardi* Greene, Bull. Torrey Bot. Club 10: 41. 1883. *Sphaerostigma hilgardi* (Greene) Small, Bull. Torrey Bot. Club 23: 188. 1896. *Sphaerostigma andinum* var. *hilgardii* (Greene) A. Nelson, Bot. Gaz. (Crawfordsville) 40: 56. 1905. *Oenothera andina* var. *hilgardii* (Greene) Munz, Bot. Gaz. 85: 251. 1928. *Camissonia hilgardii* (Greene) P. H. Raven, Brittonia 16: 285. 1964. *Holmgrenia hilgardii* (Greene) W. L. Wagner & Hoch, Syst. Bot. Monogr. 83: 210. 2007, nom. illeg. TYPE: U.S.A. Washington: Klickitat or Yakima Co., moist alkaline soil of the Klickitat Swale, July 1882, *E. Hilgard s.n.* (holotype, GH).

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Validation of the Name *Chelonopsis chekiangensis* (Lamiaceae), a Species from Eastern China

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ABSTRACT. *Chelonopsis chekiangensis* C. Y. Wu, originally described from Zhejiang, China, was not validly published in 1959 because no type specimen was designated. To enable formal use of the name, the species is validated here, as is *C. chekiangensis* var. *brevipes* C. Y. Wu & H. W. Li, a variety from Guangdong Province.

Key words: *Chelonopsis*, China, Lamiaceae.

A nomenclatural problem was noticed while working on the phylogeny of the genus *Chelonopsis* Miquel. Four specimens were cited for *C. chekiangensis* C. Y. Wu, but without indication of a type in the protologue (Wu, 1959). Consequently, *C. chekiangensis* is not a validly published name under Art. 37.1 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006). Unfortunately, this oversight was not discovered in the taxonomic treatment for the English, updated edition of the *Flora of China* (Li & Hedge, 1994). To enable its formal use, the name is here validated, with one of these four originally cited specimens (Wu, 1959) designated as the holotype. Furthermore, because *C. chekiangensis* was not validly published, Wu and Li (Wu et al., 1965) did not validly publish the variety *C. chekiangensis* var. *brevipes* (Art. 43.1, McNeill et al., 2006), and this name is also validated herein.

Because the two names and their validating diagnoses are here ascribed to Wu (1959) and Wu and Li (Wu et al., 1965), respectively, under Art. 46.2 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006), they remain the respective authors of these names.

Chelonopsis chekiangensis C. Y. Wu, sp. nov. TYPE: China. Zhejiang: Hangzhou, fanchiao, 13 Oct. 1927, *R. C. Ching 3724* (holotype, PE).

The validating description and diagnosis were previously published by Wu (1959: 27).

This species is similar to *Chelonopsis moschata* Miquel, but the leaves are lanceolate, 3–15 × 1.5–4.5 cm, strigose along the veins, sparsely hirsute adaxially, inconspicuously glandular along veins abaxially (vs. blade oblong or narrowly oblong, 7–18 × 2–9 cm, sparsely pubescent on adaxial surface and on the nerves on abaxial surface); the leaf base is cuneate-attenuate, the margin irregularly callose-serrate (vs. base cuneate to truncate and frequently auriculate, margin acute serrate); and the cymes are 3- to 5-flowered (vs. 1- to 3-flowered).

Distribution. The species was described from Zhejiang Province in eastern China and it is distributed from Anhui to Guangdong provinces.

Paratypes. CHINA. **Anhui:** She Xian, 5 Sep. 1995, *J. N. Dong 1131* (MO); s. loc., 18 Sep. 1925, *R. C. Ching 9045* (E). **Guangdong:** Ruyuan, 3 Nov. 1934, *X. P. Gao 54730* (KUN). **Jiangxi:** Huang-long-shan, 20 Aug. 1847, *Y. G. Xiong 5669* (LBG); Zhen-ru-si, 26 Oct. 1953, *Y. G. Xiong 07358* (LBG). **Zhejiang:** Ningbo, 20 Aug. 1953, *T. Hong & B. J. Gen 276* (KUN); Qing-liang-feng, 20 Sep. 2007, *C. L. Xiang 037* (KUN); Tian-mou-shan, 18 Aug. 1924, *R. C. Ching 5057* (K); Tian-mou-shan, 30 Aug. 1957, *X. Y. He 25632* (IBSC); Tian-mou-shan, 17 Aug. 1956, *H. Q. Zhu 00266* (IBSC); Tiantai, 19 Sep. 1964, *H. X. Zhou 141* (MO); Zhenhai, 8 July 1928, *G. G. Zhong s.n.* (KUN).

Chelonopsis chekiangensis C. Y. Wu var. **brevipes** C. Y. Wu & H. W. Li, var. nov. TYPE: China. Guangdong: Ju-yuan, 14 Oct. 1936, *J. Li 2098* (holotype, IBSC).

The validating description and diagnosis were previously done by Wu and Li (Wu et al., 1965: 154).

This variety differs from the autonym *Chelonopsis chekiangensis* C. Y. Wu var. *chekiangensis* by having shorter peduncles, which range from 2 to 4 mm in length (vs. 10–20 mm in variety *chekiangensis*).

Distribution. This variety is only known from Guangdong and Jiangxi provinces, in moderately moist forest on mountains.

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Paratypes. CHINA. **Guangdong:** Ruyuan, *L. Deng 5601* (KUN). **Jiangxi:** Suichuan, 28 Sep. 1963, *J. S. Yue 1363* (IBSC, KUN).

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A Contribution to *Astragalus* sect. *Campylanthus* (Fabaceae) in Iran: Two New Species and a Diagnostic Key

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Abstract. *Astragalus ghanbarianii* Maassoumi, Podlech & Zarre and *A. nervifolius* Maassoumi, Podlech & Zarre, two new species of *Astragalus* sect. *Campylanthus* Bunge (Fabaceae) from Iran, are described and illustrated. Because of the considerable changes in the delimitation of this section, a new diagnostic key to its species is presented. Moreover, *A. susianus* Boissier subsp. *sericeus* Tietz is reduced to synonymy of *A. chalaranthus* Boissier & Haussknecht.

Key words: *Astragalus*, Fabaceae, Iran, IUCN Red List, section *Campylanthus*.

The Iranian highlands, with about 1000 species of *Astragalus* L. (Fabaceae), are one of the most significant diversification centers of the genus (Podlech, 1999). In addition to the numerous endemic species, several natural groups recognized as sections are distributed exclusively in Iran. In the thorny *Astragalus* (Zarre, 2000), the monotypic section *Semnanenses* Zarre & Podlech (Zarre & Podlech, 2001a), together with section *Microphysa* Bunge and section *Campylanthus* Bunge (Bunge, 1868, 1869; Boissier, 1872; Tietz, 1988), are endemic to Iran. Species of both section *Campylanthus* and section *Microphysa* are distributed mainly in the Zagros Mountains of western Iran. Extensive support has been offered for the close relationship between these sections (Tietz, 1988; Zarre, 2000; Podlech et al., 2001; Kazempour Osaloo et al., 2003, 2005), as well as for their possible close relation to section *Anthylloidei* DC. (Tietz & Zarre, 1994).

The Zagros Mountains is an important speciation center for several Irano-Turanian and Mesopotamian plant genera (Zohary, 1973). The southern part of this range is not well collected by botanists. Most species of *Astragalus* here are narrowly endemic (Tietz & Zarre, 1994; Podlech et al., 2001; Zarre & Podlech, 2001b).

The study of newly collected material in Iranian herbaria led to the discovery of the two new species described below for *Astragalus* sect. *Campylanthus*. Moreover, molecular studies using ITS sequences (Kazempour Osaloo et al., 2003, 2005) and this morphological study support the exclusion of *A. magistratus* Maassoumi, Ghahreman & Mozaffarian from section *Campylanthus*. *Astragalus ahmad-parsae* Maassoumi (Maassoumi, 1998) was overlooked in the *Flora Iranica* (Podlech et al., 2001), and the separation of *A. chalaranthus* Boissier & Haussknecht from *A. susianus* Boissier subsp. *sericeus* Tietz in that account is highly doubtful. All these findings support the necessity for providing a new key to the species of section *Campylanthus*.

Key to the Species of *Astragalus* sect. *Campylanthus* in Iran

1a. Inflorescences globose, heads overtopping the leaves, 10- to 20-flowered.
  2a. Calyx 16–23 mm long, teeth 11–17 mm long; heads 3–4.5 cm diam.; standard (13–)15–20 mm long, with elliptic to broadly elliptic limb . . . . . *A. tricholobus* DC. subsp. *tricholobus*
  2b. Calyx (10–)15–28 mm long, teeth 6–10 mm long; heads 1.5–3 cm diam.; standard 11–14(–18) mm long, with orbicular to broadly elliptic limb. . . . . *A. tricholobus* subsp. *hohenackeri* (Boissier) Tietz
1b. Inflorescences ovate to cylindrical, if globose then shorter than the leaves, often more than 20-flowered.
  3a. Fruiting calyx obviously inflated, 6–9 mm diam. . . . . *A. argyrostachyus* Boissier

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3b. Fruiting calyx only slightly wider than flowering one, not inflated, 3–5 mm wide.
4a. Bracteoles always present; inflorescence ± loose . . . . . *A. ecbatanus* Bunge
4b. Bracteoles absent or rarely present; inflorescences dense.
5a. Stipules membranous, hyaline; bracts membranous.
6a. Median stipules ca. 8 mm long; median leaves with 8 to 10 pairs of leaflets, up to 11 × 1–2 mm; inflorescence globose to ovate, 2–3.5 cm diam. . . . . *A. ghanbarianii* Maassoumi, Podlech & Zarre
6b. Median stipules 12–15 mm long; median leaves with 5 to 7 pairs of leaflets; median leaflets 12–18 × 3–6 mm; inflorescence cylindrical, longer.
7a. Median wings 15–16 mm long, the limb 9–10 mm long . . . . . *A. ahmad-parsae* Maassoumi
7b. Median wings 11–13 mm long, the limb 6–7.5 mm long . . . . . *A. nervifolius* Maassoumi, Podlech & Zarre
5b. Stipules chartaceous; bracts chartaceous (but membranous in *A. susianus*).
8a. Inflorescences 1.5–3 cm long, shorter than leaves, peduncles 0.3–1.5 cm long; leaflets of median leaves in 7 to 12 pairs.
9a. Stipules connate to each other at most up to the middle; rachis and leaflets spreading pubescent; bracts hyaline, median ones 6–11 mm long, often acuminate at tip, covered with short hairs only . . . . . *A. susianus* Boissier
9b. Stipules connate to each other at least from the middle up to the apex; rachis and leaflets appressed sericeous; bracts chartaceous, median ones 5–7 mm long, shortly acuminate, covered with short and long hairs . . . . . *A. chalaranthus* Boissier & Haussknecht
8b. Inflorescences 3–9 cm long, overtopping leaves, peduncles 2–15 cm long; leaflets of median leaves in 12 to 22 pairs.
10a. Median leaves with 12 to 22 leaflet pairs; bracts villous, their hairs up to 2 mm long . . . . . *A. campylanthus* Boissier
10b. Median leaves with 6 to 12 leaflet pairs; bracts with short appressed hairs up to 0.5 mm long or glabrous . . . . . *A. erinifolius* Pau

1. **Astragalus ghanbarianii** Maassoumi, Podlech & Zarre, sp. nov. TYPE: Iran. Fars: Jahrom, old rd. of Darab-Fasa, pass at 1200 m, 17 Apr. 2002, *G. Ghanbarian 78* (holotype, TARI). Figure 1.

Affinis *Astragalo ahmad-parsae* Maassoumi sed ab eo stipulis 4–10 mm (nec 12–15 mm) longis, foliolis usque ad 10- (nec 5- ad 7-) jugis, 1–2 mm (nec 3–6 mm) latis, pedunculo usque ad 1 cm (nec 1–3 cm) longo, racemo 2–3.5 cm (nec 5–7 cm) diam. et laminis alarum 6–7.5 mm (nec ca. 10 mm) longis; ab *A. susiano* Boissier calyce 12–15 mm (nec usque ad 11 mm) longo, dentibus 8–10 mm (nec usque ad 7 mm) longis, vexillo usque ad 13 mm (nec usque ad 10.5 mm) longo et foliolis usque ad 13 mm (nec usque ad 10 mm) longis differt.

Dwarf cushions, 20–50 cm tall, loosely branched at the base; indument exclusively white, on the calyx to 4 mm long, otherwise 0.1–2 mm; stems from a prostrate base ascending, 1–4 mm diam. in first year, growing 1–5 cm per year, below stipules densely appressed villous, gradually glabrescent; old stems covered by remainder of last year's thorns and stipules; stipules membranous, hyaline at margins, yellowish white, 4–10 mm, with 3 to 5 parallel veins, ovate-triangular, acuminate, 2–6 mm adnate to the petiole, otherwise 1–4 mm connate, densely furnished with long adpressed straight hairs, gradually glabrescent, ciliate at margins. Leaves 0.8–4.5 cm; rachises ± remote, rigid, thick, densely covered by short spreading hairs, gradually glabrescent; petiole 0.4–1 cm (1/5–1/2 as long as the rachis); terminal spine 1–4× longer than uppermost leaflet pair; leaflets 3 to 10 pairs, grayish green, strongly complicate, 3–11 × 1–2 mm, linear to narrowly oblong or elliptic, acute at tip, with a mucro < 0.3 mm long, both surfaces densely to sparsely appressed pubescent. Inflorescence densely globose to ovoid, 2–3.5 cm diam., 20- to 30-flowered; peduncle 0.5–1 cm, densely villous; bracts membranous, yellow, 5–8 mm, outer ones ovate to broadly ovate, inner ones narrowly ovate to oblong or elliptic, acuminate at tip, densely appressed short pubescent, ciliate at margins; bracteoles absent; calyx papery, yellowish white, campanulate-tubular, 12–15 mm, 3–4 mm diam., with 10 to 15 parallel nerves, densely appressed pubescent; teeth 8–10 mm, ca. 2× longer than the tube, filiform; petals pink to light purple (or brown when dried), claws of wings and the keel only basally adnate to stamen tube; standard 10–13 mm; limb orbicular, 6–9 mm diam., retuse at tip; wings 9–13 mm; limbs 6–7.5 × 2–2.5 mm, obovate, obtuse at tip; auricle 0.7–1.3 mm; claw as long as the limb; corolla keel 8–12 mm, slightly shorter than wings; limbs 5–6 × 2.5–3 mm, obovate-triangular, with ± rectangular lower edge and straight upper edge; claw 5.5–7 mm; stamens as long as the keel, the free part 2–2.5 mm; ovary densely shortly sericeous, sessile; style 8–10 mm, pubescent at the base or up to lower 1/3. Mature fruits and seeds not seen.

Distribution. *Astragalus ghanbarianii* shares a similar, but somewhat more western, distribution pattern with *A. brevirhachis* Tietz & Zarre on the southern Zagros Mountains (Tietz & Zarre, 1993). The southern part of the Zagros Mountains is not well collected botanically, and it seems that the area may be an important diversification center for *Astragalus*.

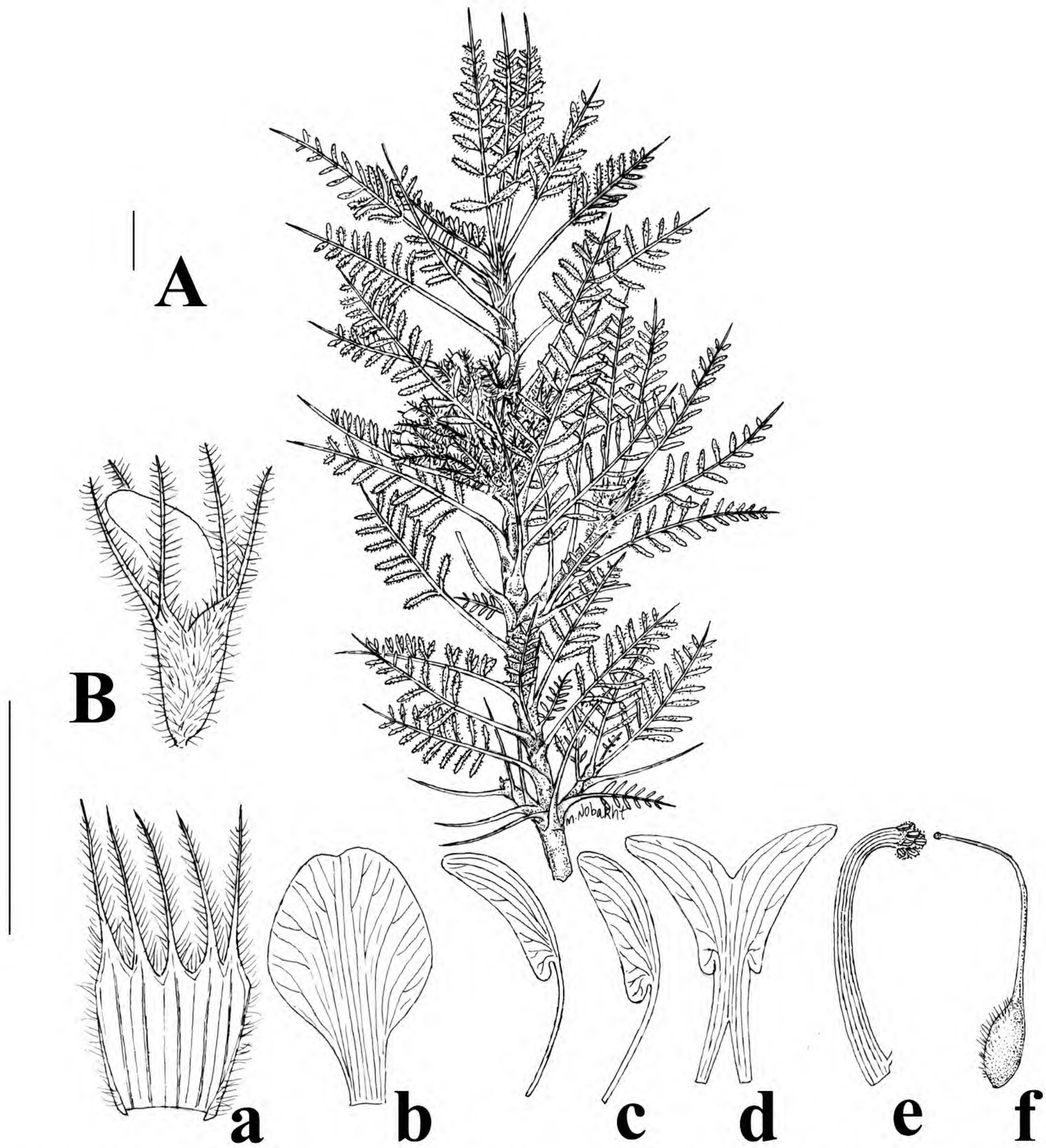

Figure 1. *Astragalus ghanbarianii* Maassoumi, Podlech & Zarre. —A. Flowering branch. —B. Flower. —a. Opened calyx. —b. Standard. —c. Wings. —d. Keel. —e. Staminal tube. —f. Ovary. Scale bars = 10 mm. Drawn from the holotype, *G. Ghanbarian 78* (TARI), by A. Nobakht.

IUCN Red List category. Because of the paucity of collections, the species cannot be assessed for its conservation status and is considered Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The species epithet recognizes G. Ghanbarian, a researcher at the Research Center of Forests and Rangelands, Shiraz (Iran) and the collector of the plant.

Species concept. Astragalus ghanbarianii is the second species of section *Campylanthus* with standards longer than 12 mm. This character connects it to *A. ahmad-parsae* (Maassoumi, 1998), from which it differs by having linear to narrowly oblong or rarely elliptic leaflets (vs. predominantly elliptic leaflets), racemes 2–3.5 mm long (vs. 5–7 cm), and smaller wing limbs (6–7.5 mm vs. ca. 10 mm long). The short and densely flowered inflorescences in *A. ghanbarianii* relate it to the core group of section *Campylanthus*, closest to *A. susianus* (see Tietz, 1988). The latter species has a shorter calyx (8–11 mm long) and petals (8–10.5 mm long) compared to *A. ghanbarianii*.

2. Astragalus nervifolius Maassoumi, Podlech & Zarre, sp. nov. TYPE: Iran. Khuzestan: Dehdez to Karun River, around Lirsiah, ca. 1000 m, 17 June 1995, *V. Mozaffarian 74479* (holotype, TARI; isotype, M). Figure 2.

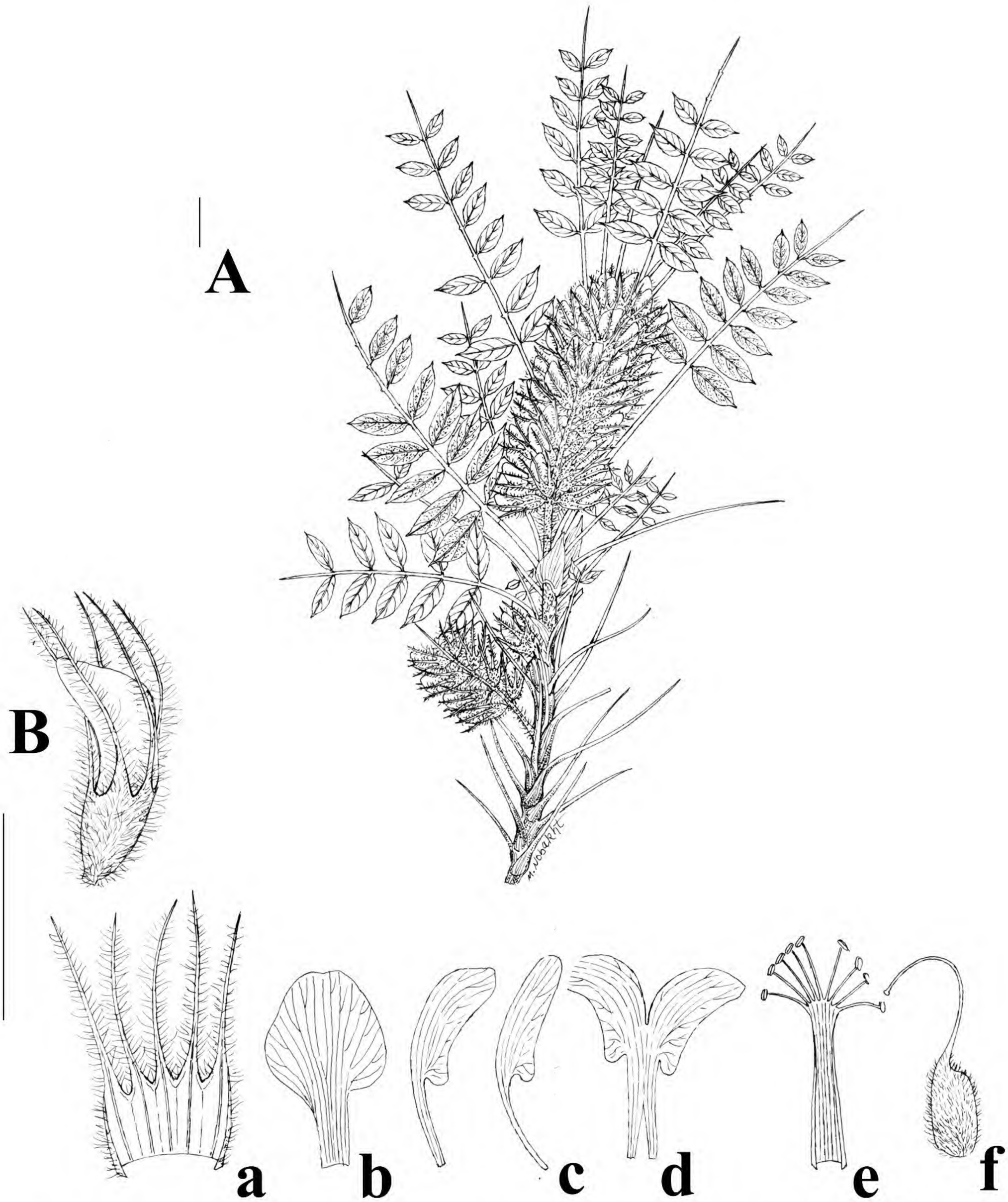

Figure 2. *Astragalus nervifolius* Maassoumi, Podlech & Zarre. —A. Flowering branch. —B. Flower. —a. Opened calyx. —b. Standard. —c. Wings. —d. Keel. —e. Staminal tube. —f. Ovary. Scale bars = 10 mm. Drawn from the holotype, *V. Mozaffarian 74479* (TARI), by A. Nobakht.

Valde affinis *Astragalo ahmad-parsae* Maassoumi sed ab eo alis brevibus usque ad 13 mm (nec 13–16 mm) longis et laminis earum 6–7.5 mm (nec 9–10 mm) longis; ab *A. susiano* Boissier stipulis membranaceis (nec chartaceis) 7–13 mm (nec usque ad 9 mm) longis, foliolis 3- ad 7- (nec 5- ad 14-) jugis, remotis (nec congestis) 4–15 × 2–5 mm (nec 0.5–10 × 0.5–2.5 mm), planis (nec complicatis), longe mucronatis (nec breviter mucronulatis), prominenter nervosis, inflorescentis cylindraceis 3–5 cm longis (nec globosis usque ovoideis et usque ad 3 cm longis) et bracteis usque ad 15 mm (nec usque ad 11 mm) longis; ab *A. campylantho* Boissier stipulis membranaceis (nec chartaceis), foliolis 3- ad 7- (nec 8- ad 22-) jugis usque ad 15 mm (nec usque ad 10 mm) longis, remotis (nec congestis), planis (nec complicatis), longe mucronatis (nec breviter mucronulatis) et laminis carinae obtusis (nec acuminatis) differt.

Dwarf cushions, 20–50 cm tall, densely branched at base; hairs exclusively white, on the calyx up to 4 mm long, otherwise 0.1–2 mm; stem ascending, 1–

4 mm diam. in first year, growing 1–10 cm per year, below stipules densely appressed pubescent, gradually glabrescent; old stems covered by remainder of last year's thorns and stipules; stipules membranous, hyaline, yellowish white, 7–13 mm, with 5 to 11 parallel nerves, widely ovate-triangular, acute or acuminate at tip, 1.5–5 mm adnate to the petiole, otherwise 1–3 mm connate, sparsely furnished with long adpressed straight hairs, soon glabrescent. Leaves 0.8–8 cm; rachises ± dense, rigid, thick, densely covered by tomentose hairs, gradually glabrescent; petiole 0.4–2.5 cm (1/4–1/2 as long as the rachis); terminal spine as long as the uppermost leaflet pair; leaflets 3 to 7 pairs, grayish green, flattened, 4–15 × 2–5 mm, ovate to elliptic, obtuse at tip, with a mucro 1–2.5 mm long, both surfaces densely to sparsely tomentose. Inflorescence densely cylindrical to ovate, 3–5 cm, 2–2.5 mm diam., shorter than leaves, 40- to 100-flowered; peduncle 0.5–2.5 cm, densely villous; bracts membranous, yellow, 10–15 mm, outer ones ovate to elliptic, inner ones narrowly ovate to oblong or linear, acuminate at tip, sparsely pubescent to glabrous, ciliate at margins; bracteoles absent; calyx papery, yellowish white, campanulate-tubular, 12–15 mm, 3–4 mm diam., with 10 to 15 parallel veins, densely appressed pubescent; teeth 8–10 mm, ca. 2× longer than the tube, filiform; petals pink to light purple, claws of wings and the keel only basally adnate to stamen tube; corolla standard 12–13 mm; limb orbicular, 6–9 mm diam., retuse at apex; corolla wings 11–13 mm; limbs 6–7.5 × 2–2.5 mm, obovate, obtuse at tip; auricle 0.7–1.3 mm; claw as long as the limb; corolla keel 10–12 mm, slightly shorter than wings; limb 5–6 mm, 2.5–3 mm deep, obovate-triangular, with ± rectangular lower edge and straight upper edge; claw 5.5–7 mm; stamens as long as keel, free part 2–2.5 mm; ovary densely shortly sericeous, sessile; style 8–10 mm, pubescent at base or up to lower 1/3. Mature fruits and seeds not seen.

Distribution. *Astragalus nervifolius* is distributed in the southern part of the Zagros Mountains along the border of Chahar-Mahal and Khuzestan provinces.

IUCN Red List category. Because of the paucity of collections, the species cannot be assessed for its conservation status and is considered Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Species concept. *Astragalus nervifolius* possesses large petals similar to *A. ghanbarianii* and can therefore be compared with *A. ahmad-parsae* (see above). Ovate to elliptic leaves with prominent reticulate venation (for which the specific epithet is selected) that are characteristic for this species separate it from *A. ghanbarianii* and relate it to *A. ahmad-parsae*. However, *A. nervifolius* differs principally from *A. ahmad-parsae* in the size of petals, which are 11–13 mm long (vs. 13–16 mm long in *A. ahmad-parsae*) with the wing limbs 6–7.5 mm (vs. 9–10 mm long). *Astragalus nervifolius* has cylindrical inflorescences that are shorter than the leaves, a character that it shares with *A. susianus* and *A. chalaranthus* (see Tietz, 1988). *Astragalus nervifolius* differs from both of these species, however, by its large bracts (10–15 mm vs. 9–12 mm long) and stipules (7–13 mm vs. 6–9 mm long).

Circumscription of *Astragalus susianus*

Tietz (1988) recognized two subspecies in *Astragalus susianus*: subspecies *susianus* was said to have leaflets with spreading hairs, whereas those of subspecies *sericeus* have appressed hairs. Moreover, the bracts are hyaline but large (6–11 mm long) in subspecies *susianus*, whereas they are chartaceous and smaller (5–7 mm long) in subspecies *sericeus*. *Astragalus susianus* differs from *A. chalaranthus* primarily by having the stipules connate up to the middle instead of up to the apex. Interestingly, the distribution of *A. chalaranthus* overlaps significantly with that of *A. susianus* subsp. *sericeus*. Furthermore, the presence of hyaline and short bracts in both taxa supports their union. Therefore, *A. susianus* subsp. *sericeus* is reduced herein to synonymy of *A. chalaranthus*.

Astragalus chalaranthus Boissier & Haussknecht, in Boissier, Fl. Orientalis 2: 390. 1872. TYPE: [Iran.] SW Persia, Mt. Kuh Sawers, Eschker, 8000 ft., July 1868, *Haussknecht s.n.* (holotype, G-BOIS).

Astragalus susianus Boissier subsp. *sericeus* Tietz, in Mitt. Bot. Staatssamml. München 27: 174. 1988. Syn. nov. TYPE: Iran. Fars: 5 km E of Mian Kotal, 80 km W of Shiraz, 2200 m, 28 June 1964, *M. L. Grant 15868* (holotype, W).

Acknowledgments. We are grateful to Ihsan Al-Shehbaz (MO) for his editing and critical review of the manuscript. We are indebted to M. Nobakht (TARI) for preparing the illustrations of the new species. The revision of *Astragalus* sect. *Campylanthus* was prepared as part of a project supported by the Research Council of Tehran University to Shahin Zarre; additional funding from Alexander von Humboldt Stiftung supported Shahin Zarre's travel to study the type material in Munich.

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New Species of *Alstroemeria* (Alstroemeriaceae) from Brazil

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Abstract. Two new species of *Alstroemeria* L. (Alstroemeriaceae) from Brazil are described: *A. albescens* M. C. Assis from Rio Grande do Sul and *A. calliantha* M. C. Assis from Minas Gerais. Descriptions, comments, and illustrations are provided.

Resumo. Duas novas espécies de *Alstroemeria* L. (Alstroemeriaceae) do Brasil são aqui descritas: *A. albescens* M. C. Assis do Rio Grande do Sul e *A. calliantha* M. C. Assis de Minas Gerais. Descrições, comentários e ilustrações são aqui apresentadas.

Key words: *Alstroemeria*, Alstroemeriaceae, Brazil, IUCN Red List, Minas Gerais, Rio Grande do Sul.

The genus *Alstroemeria* L. (Alstroemeriaceae) comprises perennial herbs that are erect and rhizomatous with storage roots. The leaves are sessile, simple, entire, generally resupinate (twisted near the base or along the lamina), and either concentrated toward the stem apex, distributed along the stem, or as a rosette on a short stem. Blades can be membranous, chartaceous, or leathery; linear, lanceolate, elliptic, or oblong; and either glabrous on both faces or papillose on the adaxial face. The inflorescence is terminal as an umbel-like, simple or branched cyme of two to many flowers or rarely the flowers may be solitary, wrapped within the leaflike bracts. Flowers are zygomorphic and bisexual, with six tepals petaloid and free, in two whorls. The tepals may be similar or different, the inner often shorter, patterned, and basally narrowed into a canaliculate base with nectariferous ducts. The stamens are six, free, and in two whorls. The anthers are pseudobasifixed, with longitudinal introrse dehiscence. The ovary is inferior, syncarpous, 3-carpellate, and trilocular with axilar placentation; the style is apical, with three stigmas, and many anatropous ovules. The fruit is a dehiscent, loculicidal capsule, and the seeds are globose, without a sarcotesta.

Also known as the Lily of the Incas, *Alstroemeria* species and hybrid taxa have gained worldwide popularity as cut flowers due to their appearance and excellent keeping quality. They are also satisfactory for growing in pots and for use in gardens and landscaping.

The genus is restricted to South America and is found in a wide range of habitats including cloud forests, swamps, and desert areas, from the high Andes to marshy lands. Despite the lack of knowledge and studies regarding population dynamics, as well as the scarcity or absence of exsiccatae for *Alstroemeria* in most of Brazil, the restricted geographic distribution for most species suggests the vulnerability of its taxonomic populations, mainly from anthropomorphic actions.

Bayer (1987) recognized 31 Chilean species of *Alstroemeria*. Sanso (1996) reviewed the Argentinean *Alstroemeria* species and recognized 10 taxa with one endemic species. Taxonomic revision of the genus for Brazil (Assis, 2001) distinguished 38 species distributed in the eastern regions of the country, including 35 endemic species and 10 newly described species (Assis & Mello-Silva, 2004; Assis, 2002, 2003, 2004, 2006). With the recognition of two additional species, described below, the genus *Alstroemeria* in Brazil now comprises 40 species.

1. Alstroemeria albescens M. C. Assis, sp. nov. TYPE: Brazil. Rio Grande do Sul: Porto Alegre,

doi: 10.3417/2007073 Novon 19: 145–149. Published on 18 June 2009.

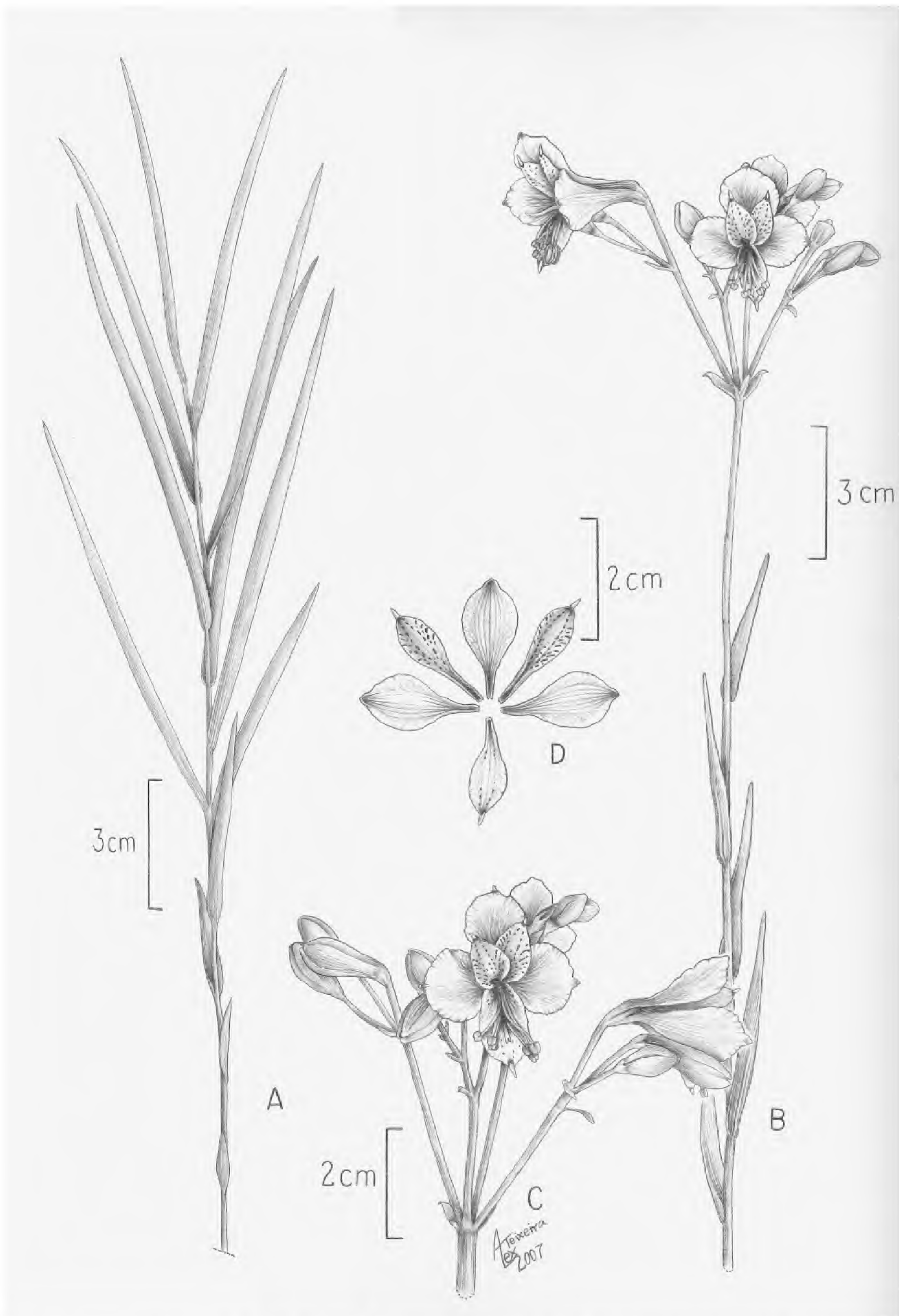

Figure 1. *Alstroemeria albescens* M. C. Assis. —A. Vegetative stem. —B. Reproductive stem. —C. Inflorescence. —D. Tepals, the inner ones spotted. Drawn from the holotype *Setúbal 204* (ICN).

Morro São Pedro, 30°11′24″S, 51°06′42″W, 130–160 m, 21 Jan. 2007 (fl.), *R. B. Setúbal 204* (holotype, ICN; isotypes, HB, K, MO). Figure 1.

Haec species quoad caules vegetativos *Alstroemeriae amabili* M. C. Assis, *A. malmeanae* Kraenzlin et *A. sellowianae* Seubert ex Schenk simillima, sed ab eis floribus albolilacinis atque tepalis internis rubropunctatis distinguitur.

Table 1. Morphological characters distinguishing *Alstroemeria albescens*, *A. sellowiana*, *A. amabilis*, and *A. malmeana*.

Character	*A. albescens*	*A. sellowiana*	*A. amabilis*	*A. malmeana*
Flower color	white-lilac	yellow-orange	orange-red	red
Inner tepal pattern	ruby-spotted	ruby-spotted	ruby-spotted	unpatterned
Flower length	2.2–3 cm	2.1–3.2 cm	2.5–3.5 cm	1.8–2.2 cm
Flower scent	absent	present	absent	absent

Perennial herb ca. 0.7 m tall; rhizome with storage roots; stems cylindrical, glabrous. Leaves of the vegetative stem evenly distributed along the stem, not resupinate, blade linear, 1.5–11.5 × 0.4–0.5 cm, coriaceous, apex acuminate, base cuneate, both faces glabrous; leaves of the reproductive stem distributed along the stem, not resupinate, blade linear or linear-lanceolate, 1.5–6 × 0.4–0.6 cm, coriaceous, apex acuminate, base truncate, both faces glabrous. Inflorescence an umbel-like, composite cyme of 3 to 10 flowers; pedicel glabrous, 2–2.5 cm; bracts leaflike, chartaceous, 0.8–0.9 cm; bracteoles membranous, 0.3–0.5 cm. Flowers patent, campanulate, white-lilac, 2.2–3 cm; tepals 6 in 2 whorls; the outer tepals unpatterned, all 3 very similar, spatulate; the upper one ca. 2 × 0.8 cm; the lower two ca. 1.9 × 0.7 cm; the inner tepals ruby spotted, all 3 very similar; the upper two ca. 1.9 × 0.5 cm; the lower one ca. 1.9 × 0.5 cm; stamens 6, included, filaments glabrous, ca. 1–2 cm; stigma included, style glabrous, ca. 1.5–1.6 cm. Capsules 1.3–1.5 × 0.7–1 cm.

Habitat and distribution. *Alstroemeria albescens* is endemic to the Morro São Pedro in Porto Alegre, state of Rio Grande do Sul, and is found on rocky outcrops at 130 to 160 m elevation.

IUCN Red List category. The new species is Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001), and needs further investigation.

Phenology. Flowers were collected from January to March.

Etymology. The epithet is from the Latin "albescens," meaning "becoming white" or "whitish," in reference to the color of the flowers.

Discussion. *Alstroemeria albescens* is characterized by its whitish lilac flowers and ruby-spotted inner tepals. The vegetative stems of this species are very similar to *A. amabilis* M. C. Assis, *A. malmeana* Kraenzlin, and *A. sellowiana* Seubert ex Schenk, which occur in the South Region of Brazil, from Parana to Rio Grande do Sul states. The new species can be differentiated from these related taxa by the floral characters indicated in Table 1.

Paratypes. BRAZIL. **Rio Grande do Sul:** Porto Alegre, Morro São Pedro, 30°11′24″S, 51°06′42″W, fl., *R. B. Setúbal 246* (ICN), fl., *R. B. Setúbal 200* (UEC); fr., *R. B. Setúbal & D. Fuhro 201* (ICN).

2. Alstroemeria calliantha M. C. Assis, sp. nov. TYPE: Brazil. Minas Gerais: Santa Maria do Salto, 40°03′22″S, 16°24′19″W, 21 Feb. 2005 (fl.), *J. R. Stehmann, J. A. Lombardi & R. C. da Mota 4007* (holotype, BHCB). Figure 2.

Haec species praecipue quoad characteres florales *Alstroemeriae foliosae* Martius ex Schultz & Schultz f. simillima, sed ab ea foliis membranaceis subtus epappilosis per caulem floriferum sparse distributa econgesta distinguitur.

Perennial herb 0.7–1 m tall; rhizome with storage roots; stems cylindrical, glabrous. Leaves of the vegetative stems congested at stem apices, resupinate, blade oblong or elliptic, 9.5–18.5 × 2.2–3.4 cm, membranous, apex acute, base attenuate, both faces glabrous; leaves of the reproductive stem sparsely distributed along the stem, not resupinate, reduced, blade lanceolate or narrowly lanceolate, 2–3 × 0.2–0.3 cm, membranous, apex acuminate, base cuneate, both faces glabrous. Inflorescence an umbel-like, simple cyme of 2 to 5 flowers; pedicels glabrous, to 2.7 cm; bracts leaflike, membranous, 1–3.5 × 0.1–0.4 cm. Flowers patent, campanulate, reddish or yellow-red, 4.7–5 cm; the outer tepals unpatterned, these 3 similar, obovate, apex mucronate, base attenuate; the upper one 4.4–4.7 × ca. 1.5 cm; the lower two 3.9–4 × 1.4–1.5 cm; the inner tepals ruby striped, these 3 similar, elliptic, apex acuminate, base attenuate; the upper two 3.8–4 × 0.5–0.7 cm; the lower one ca. 3.4 × 0.4 cm; stamens included, filaments glabrous, ca. 3–3.5 cm; stigma included, style glabrous, ca. 2.8–3 cm. Capsules not seen.

Habitat and distribution. *Alstroemeria calliantha* is found rarely in transitional areas of caatinga and rainforest, in forest underbrush, in the state of Minas Gerais.

IUCN Red List category. The new species is Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001), and needs further investigation.

Phenology. Flowers were collected in February.

Etymology. The species epithet is derived from the Greek "calli-," meaning "beautiful," and "anthos," meaning "flower."

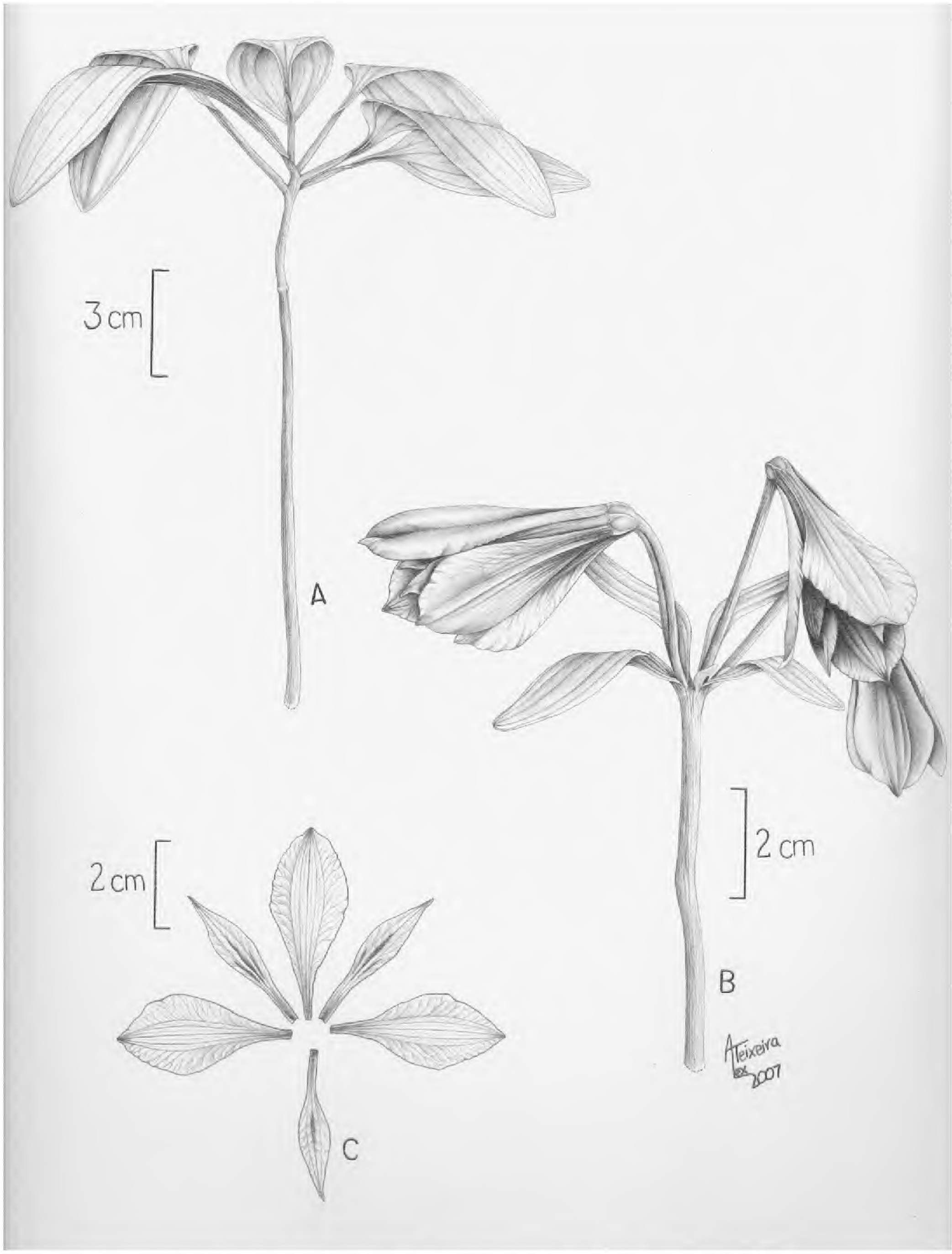

Figure 2. *Alstroemeria calliantha* M. C. Assis. —A. Vegetative stem. —B. Reproductive stem. —C. Tepals, the inner ones striped. Drawn from the holotype *Stehmann et al. 4007* (BHCB).

Discussion. *Alstroemeria calliantha* may be recognized by its membranous and glabrous leaves that are congested at the apex of the vegetative stem and the few membranous, reduced leaves that are sparsely distributed along the reproductive stem, as well as by the unpatterned outer tepals and ruby-striped inner tepals. This species is very similar to *A. foliosa* Martius ex Schultz & Schultz f., mainly in the floral

Table 2. Morphological characters distinguishing *Alstroemeria calliantha* and *A. foliosa*.

Character	*A. calliantha*	*A. foliosa*
Leaf texture	membranous	chartaceous or coriaceous
Leaf vestiture	not papillate abaxially	papillate abaxially
Vegetative leaf arrangement	congested at stem apex	congested along the stem
Reproductive leaf arrangement	sparse along the stem	congested along the stem
Leaf length of vegetative stem	9.5–18.5 cm	ca. 2.5 cm
Habitat	forest underbrush	high fields

characters. The two species differ by the coriaceous leaves that are papillate abaxially and congested along both the vegetative and reproductive stems in *A. foliosa* (Table 2).

Paratype. BRAZIL. **Minas Gerais:** Santa Maria do Salto, Fazenda Duas Barras, 16°23′54″S, 40°03′39″W, 750 m, fl., *J. A. Lombardi et al. 5941* (BHCB).

Acknowledgments. I am very grateful to Robberson Setúbal, a young enthusiastic botanist, who was the first person to collect *Alstroemeria albescens* and who introduced the species to me; to the staff of the Herbarium of the University of Minas Gerais for supplying material for the description of *A. calliantha*; and to Alex Teixeira, who drew the new species illustrations.

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Notes on the Flora of the Yucatán Peninsula IX: A Reappraisal of the Genus *Wimmeria* (Celastraceae), Including the New Species *W. lundelliana*

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Abstract. *Wimmeria lundelliana* Carnevali, R. Duno, J. L. Tapia & I. Ramírez (Celastraceae) from the Yucatán Peninsula Biotic Province (YPBP) is proposed as a new species. The novelty is described, illustrated, and its affinities discussed. It appears related to *W. obtusifolia* Standley, also from the Yucatán Peninsula, which is glabrous or glabrescent overall, with proportionally broader and blunter leaves. In comparison, an amplified description and iconography of *W. obtusifolia* are offered. An epitype is designated for *W. obtusifolia* to document the fruit morphology. A taxonomic overview of *Wimmeria* Schlechtendal & Chamisso in the YPBP is presented. The objectives of this paper are (1) to present a synopsis of the genus *Wimmeria* for the YPBP, (2) to provide a key to species identification, and (3) to describe a new species. An additional objective of this contribution is to provide an amplified description and iconography of *W. obtusifolia*, particularly of the fruits, which were previously undescribed.

Resumen. Se describe, ilustra y compara una nueva especie, *Wimmeria lundelliana* Carnevali, R. Duno, J. L. Tapia & I. Ramírez (Celastraceae) de la porción mexicana de la Provincia Biótica Península de Yucatán (YPBP). *Wimmeria lundelliana* parece estar relacionada con *W. obtusifolia* Standley, pero es glabra o glabrescente y las hojas son más anchas y obtusas. Se incluye una descripción ampliada e iconografía de *W. obtusifolia*. Se designa un epitipo para *W. obtusifolia* para describir la morfología del fruto. Se presenta una sinopsis de *Wimmeria* Schlechtendal & Chamisso en la YPBP. Los objetivos de este artículos son (1) presentar una sinopsis del género *Wimmeria* para la YPBP, (2) proporcionar una clave para la identificación de estas especies y (3) describir una nueva especie. Adicionalmente incluimos una descripción ampliada e iconografía de *W. obtusifolia*, con información de los frutos, los cuales hasta la fecha eran desconocidos.

Key words: Celastraceae, epitype, IUCN Red List, Mexico, *Wimmeria*, Yucatán Peninsula Biotic Province.

Wimmeria Schlechtendal & Chamisso (Celastraceae) is a tree or shrub genus occurring from Mexico to Panama (Moreno, 2001). The genus is vegetatively nondescript, with simple, alternate, coriaceous leaves, often clustered at the apices of branches. Leaves are frequently produced on abbreviated branches or brachyblasts. Flowers are typically celastraceous with a well-defined, fleshy, annular disk and five stamens. The most distinctive feature of the genus is the trigonous ovary that develops into a conspicuous, 3-winged, samara-like fruit resembling a Chinese lantern.

Lundell (1939) published a treatment of the genus *Wimmeria* and recognized 15 species assigned to subgenus *Euwimmeria* Lundell, with fruits longer than wide, and subgenus *Wimmeriella* Lundell, with fruits broader than long. The monophyly of these sections needs to be tested in a cladistic framework because the fruit distinction is fuzzy at best and a few species are difficult to place and seem intermediate (e.g., *W. concolor* Schlechtendal & Chamisso, *W. montana* Lundell, and *W. obtusifolia* Standley). However, for the purposes of this paper we prefer to follow Lundell's proposal since it is the only classification scheme available.

Lundell (1939) included two species for the Yucatán Peninsula Biotic Province (YPBP) area. *Wimmeria bartlettii* Lundell in subgenus *Euwimmeria* occurs from Mexico (Veracruz, Oaxaca, and Chiapas) to Panama (Chiriquí). Within the YPBP, it occurs in Petén Department in Guatemala, but has yet to be collected within Mexican territory (Lundell, 1939; Moreno, 2001). *Wimmeria obtusifolia* has been assigned to subgenus *Wimmeriella* because of its shrubby habit and pubescent leaves and twigs and is apparently endemic to the state of Yucatán (Lundell, 1939).

Recent fieldwork within the framework of the *Flora Ilustrada de la Península de Yucatán* project revealed two morphologically different populations of *Wimmeria* in the Mexican portion of the YPBP. One of them appears to be restricted to northwestern Yucatán and is a perfect match to the type material of Standley's *W. obtusifolia*, a species that had apparently not been collected since Lundell's collections in the late 1930s. A second set of populations, occurring in more humid areas of the YPBP, which has been erroneously identified as *W. obtusifolia* by previous workers and does not match any previously described species in *Wimmeria*, is herein proposed as a new species, thus bringing the total number of species in YPBP to three.

Key for *Wimmeria* Species in the Yucatán Peninsula Biotic Province, Mexico

1a. Leaves lanceolate, lanceolate-oblong, or elliptic, 6–13.5 × 1.8–5.5 cm; petiole 7–12 mm long; inflorescence forked 2 to 4×; fruits at least 1.5× longer than wide . . . . . *W. bartlettii*

1b. Leaves obovate to obovate-elliptic, or elliptic-suborbicular, 3–7 × 0.9–2.8 cm; petiole 3–8 mm long; inflorescence 1- to 2-branched; fruits wider than long, as long as wide to less than 1.2× longer than wide 2

2a. Leaves elliptic, 2–4.5 cm long, puberulent on both surfaces, apex obtuse or slightly rounded; fruits pale dull yellow to green-yellow with irregular reddish spots and blotches, 1–1.2 × 1–1.7 cm . . . . . *W. obtusifolia*

2b. Leaves obovate, elliptic to elliptic-suborbicular, 3.5–7 cm long, glabrous on both surfaces, apex rounded, retuse, rarely narrowly obtuse; fruits concolorous, 1.2–1.4 × 1.2–2 cm . . . *W. lundelliana*

1. **Wimmeria bartlettii** Lundell, Bull. Torrey Bot. Club 65: 467. 1938, as *Bartlettii*. TYPE: Guatemala. Petén: Uaxactum, 2 Apr. 1931, *H. H. Bartlett 12435* (holotype, A; isotypes, MICH, MO).

Distribution and ecology. This species is found in Mexico (Chiapas, Oaxaca, and Veracruz), Belize (El Cayo and Toledo), Guatemala (Petén), south into Panama. In Guatemala this plant grows in sapodilla and mahogany forests (Lundell, 1939). These forest types are also present in the southern portions of Campeche and Quintana Roo states, thus its occurrence in the Mexican portion of the YPBP is likely.

Discussion. *Wimmeria bartlettii* belongs in subgenus *Wimmeriella* with fruits longer than wide.

Selected specimens examined. BELIZE. **El Cayo:** Valentin, 16°45′59″N, 89°9′45″W, June–July 1936, *C. L. Lundell 6278* (MO). **Toledo:** Temash River, 16°0′N, 89°7′W, 22 Apr. 1934 (fr.), *W. A. Schipp 1296* (A, F, G, MO, NY). GUATEMALA. **Peten:** Puerto Mendez, Rolando, 17 Mar. 1970 (fl.), *Tún Ortíz 776* (MO); Uaxactun, 17°23′37″N, 89°38′1″W, 2 Apr. 1931 (fl.), *H. H. Bartlett 12435* (MO). MEXICO. **Chiapas:** Mun. Ocosingo, Nuevo Guerrero, 16°59′08″N, 91°17′06″W, 200 m, 11 Apr. 2002 (fl.), *G Aguilar 474* (CICY, XAL); Mun. Ocosingo a 1 km al S de San Javier, 16°47′22″N, 91°06′06″W, 295 m, 24 ago. 2002 (fl.), *C. Chancayun et al. 2140* (CICY, XAL). **Veracruz:** Mun. San Andres Tuxtla, faldas del Volcán San Martín, ladera S, 18°31′33″N, 95°10′48″W, 22 abr. 2001 (fl., fr.), *A. Rincón et al. 2331* (CICY, XAL).

2. **Wimmeria lundelliana** Carnevali, R. Duno, J. L. Tapia & I. Ramírez, sp. nov. TYPE: Mexico. Campeche: Mun. Calakmul, 31 km S de la caseta de entrada a Calakmul, 18°17′N, 89°50′6″W, 180 m, selva mediana subcaducifolia, árbol 10 m con flor blanca, 24 Nov. 1997, *E. Martínez, D. Álvarez, S. Ramírez, E. Lira & E. Madrid 29902* (holotype, CICY; isotypes, MEXU, MO). Figure 1.

Species haec *Wimmeriae obtusifoliae* Standley similis, sed ab ea foliis glaberrimis (vs. puberulis) latioribus apice rotundato vel emarginato, petiolis laxe pilosis (vs. puberulis) atque fructibus concoloribus majoribus differt.

Tree 10–20 m high; young branches minutely and sparsely pilose. *Leaves* borne mainly at the apex of short branches, alternate, simple, coriaceous, drying light brown on both surfaces, slightly paler abaxially; *stipules* minute, caducous. *Petioles* 4–8 mm, shallowly canaliculate, sparse and minutely pilose; *leaves* subcoriaceous, blades obovate to elliptic, elliptic, or elliptic-suborbicular, 3.5–7 × 0.9–2.8 mm, apex rounded, retuse, or rarely narrowly obtuse, base attenuate, glabrous on both surfaces, nervation penninerved, central nerve prominent abaxially, inconspicuous adaxially, secondary nerves arising at 45°–60° to central nerve at first, then curving distally, not reaching the margins or the apex, margin crenate, subcrenate to almost entire. *Inflorescences* usually 7-flowered cymes, sometimes reduced to 1 flower, 1.5–2.5 cm, peduncle 9–12 mm, minutely pilose, first-order branches ca. 2 mm, second-order branches 1-flowered, ca. 2 mm, pedicel 4–5 mm, floral bracts ca. 1 mm, narrowly triangular, concave, sparsely and minutely pilose. *Flowers* perfect, actinomorphic, bisexual; *calyx* 5-lobed, lobes subequal, transversely oblong, apex broadly rounded, 0.3–0.5 × 1.5–2 mm, glabrous on both surfaces; *corollas* pentamerous, imbricate, petals ovate, 3–3.5 × ca. 2 mm, apex obtuse, glabrous on both surfaces; *stamens* 5, inserted on margin of disk, ca. 2.5 mm, alternate to petals, filaments filiform, ca. 2 mm, glabrous, anthers basifixed, sagittate, 2-celled, longitudinally dehiscent; *disk* conspicuous, 5-lobate, surrounding the ovary, fleshy; *ovary* 2- to 3-keeled, 3-celled, base submerged in disc, ca. 1.5 mm high, style ca. 1 mm long, glabrous, stigma capitate, sometimes 2-

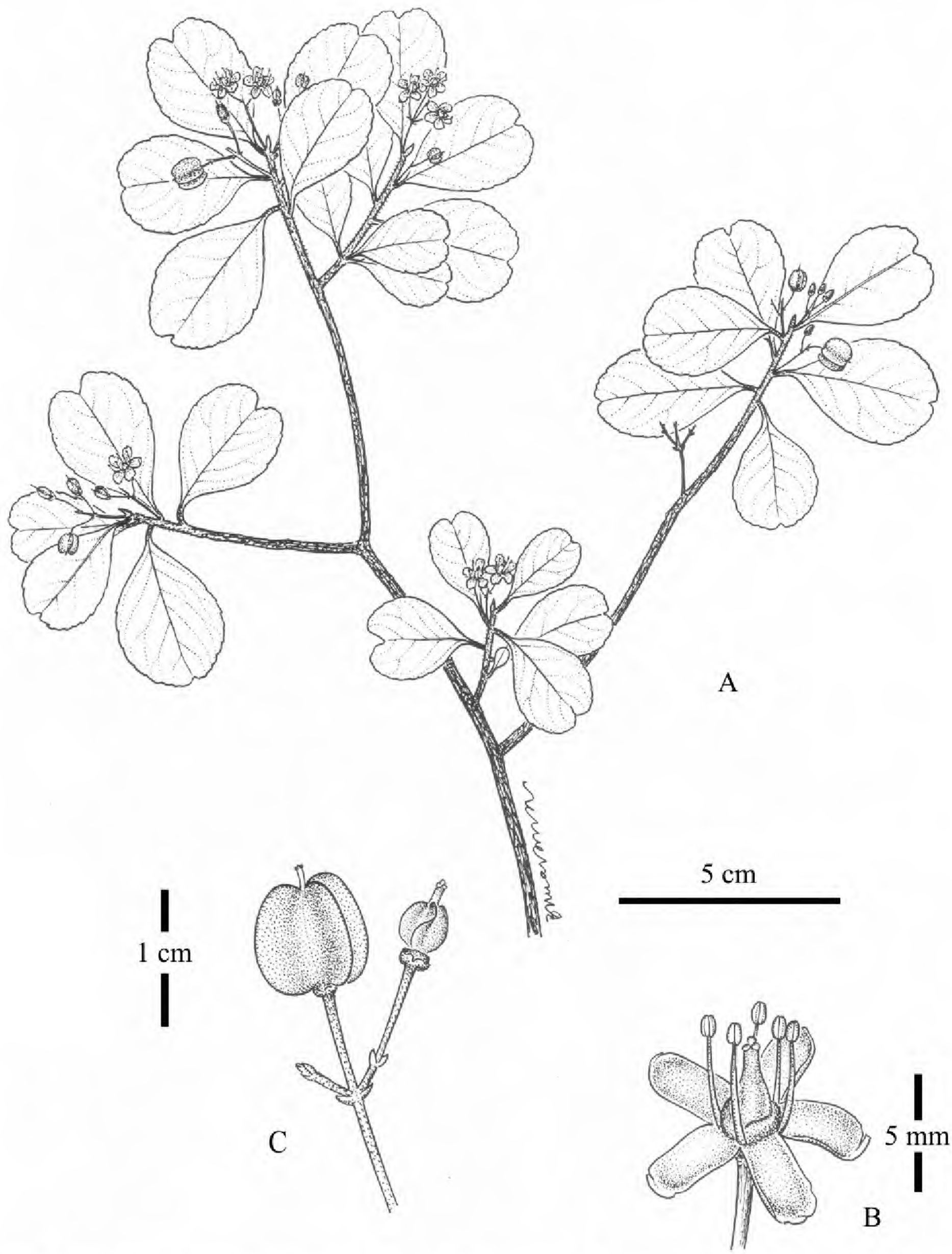

Figure 1. *Wimmeria lundelliana* Carnevali, R. Duno, J. L. Tapia & I. Ramírez. —A. Habit with inflorescence and infrutescence branches. —B. Detail of flower. —C. Detail of fruit. Drawn from *E. Martínez, D. Álvarez, S. Ramírez, E. Lira & E. Madrid 29902* (CICY).

to 3-fid. *Fruits* 3(rarely 2)-winged, depressed-orbicular, 1.2−1.4 × 1.2−2 cm, concolorous, notched at apex and base, crowned at apex by the persistent stigma and style, glabrous, indehiscent; wings membranous, with numerous fine, closely set, nearly parallel veins almost perpendicular to fruit axis.

Distribution and ecology. The new species is endemic to the Yucatán Peninsula in Mexico, only known from the south-central and eastern portions of Campeche and Quintana Roo states. It grows in subcaducifolious medium-statured forests with an annual precipitation of 1100–1400 mm (Carnevali et al., 2003).

IUCN Red List category. *Wimmeria lundelliama* can be classified as Endangered (EN) according to IUCN Red List criteria B1a,b (IUCN, 2001). It has only been collected in two localities, which are ca.

350 km distant from each other. One of these localities resides within the Calakmul Biosphere Reserve, where it is legally protected. The second known locality, however, is along the Cancún–Tulúm road, where touristic development is a major threat.

Etymology. The species epithet honors Cyrus Longworth Lundell (1907–1994), a prolific botanist who spent much of his career working in Central America, including the Yucatan Peninsula.

Discussion. *Wimmeria lundelliana* belongs to subgenus *Wimmeriella* because of its fruits that are wider than long. There are four species of *Wimmeria* in southeastern Mexico that form a natural alliance, referred to as section *Trichocarpae* by Radlkofer in 1878 (cited by Lundell, 1939: 9): *W. microphylla* Radlkofer, *W. pubescens* Radlkofer, *W. obtusifolia*, and *W. cyclocarpa* Radlkofer. *Wimmeria lundelliana* seems to belong in this alliance, although it is unusual in featuring glabrous fruits and leaves. The new species resembles *W. obtusifolia* but differs in the leaves that are longer (3.5–7 mm vs. 2–4.5 mm), usually obovate with apex rounded to emarginate (vs. elliptic with apex obtuse), and glabrous (vs. puberulent on both surfaces), and in the fruits that are 1.2–1.4 × 1.2–2 cm (vs. 1–1.2 × 1–1.7 cm). The new species resembles *W. acapulcensis* Lundell (from another alliance, Leiocarpae Radlkofer, with four species from western Mexico), but the leaves of the western Mexican species have longer petioles (5–15 mm vs. 4–8 mm) and the leaves are narrower (narrowly ovate to ovate vs. generally obovate, elliptic, or elliptic-suborbicular).

Paratypes. MEXICO. **Campeche:** Mun. Calakmul, 31 km al S de la caseta de entrada a Calakmul, 18°17′12″N, 89°50′11″W, 145 m, mediana subcaducifolia, 19 oct. 1997 (fl.), *E. Martínez, D. Álvarez, S. Ramírez, E. Lira y E. Madrid 29121* (CICY, MEXU, MO); same locality, 19 oct. 1997 (fl.), *E. Martínez, D. Álvarez, S. Ramírez, E. Lira y E. Madrid 29121a* (CICY); same locality, 19 oct. 1997 (fl.), *E. Martínez, D. Álvarez, S. Ramírez, E. Lira y E. Madrid 29123* (CICY); same locality, 24 nov. 1997 (fr.), *E. Martínez, D. Álvarez y S. Ramírez 29888* (CICY, MEXU, MO); same locality, 24 nov. 1997 (fl.), *E. Martínez, D. Álvarez y S. Ramírez* 29902 (CICY, MEXU, MO). **Quintana Roo:** Mun. Solidaridad, 7 km sur de Akumal, carr. Cancún–Tulúm, 20°23′47″N, 87°18′49″W, 17 dic. 1982 (fr.), *E. Cabrera & H. de Cabrera 3984* (MEXU, MO).

3. Wimmeria obtusifolia Standley, Field Mus. Bot. 8: 20. 1930. TYPE: Mexico. Yucatán: s. loc., 1917, *G. F. Gaumer 24259* (holotype, F; isotypes, A, M, MO, NY, US). EPITYPE: Mexico. Yucatán: Mun. Tetiz, Tetiz, 20°57′41″N, 89°56′09″W, 15 m, 20 Oct. 2006 (fl., fr.), *G. Carnevali 7185* (epitype, designated here, CICY; duplicates, MEXU, MO, NY). Figure 2.

Trees to 15 m high; young branches whitish, puberulent, older branches often lenticellate. *Leaves* small, slightly discolorous, chartaceous, brittle; petioles puberulent, 3–6 mm; blades elliptic, 2–4.5 × 1–2.5 cm, apex obtuse, sometimes slightly rounded, base acute, attenuate, margin subentire, inconspicuously crenate, sparsely puberulent on both surfaces, middle nerve distinct on adaxial surface, less distinct abaxially. *Inflorescences* cymose, to 2 cm, puberulent, lax, 3- to 7-flowered, 1.5–2 cm, peduncle 7–9 mm, minutely pilose, first-order branches ca. 0.5–1.5 mm, second-order branches 1-flowered, ca. 2 mm, pedicel 4–7 mm, floral bracts ca. 1 mm, triangular, concave, sparsely and minutely pilose. Flowers white, bracts and bracteoles inconspicuous; *calyx* 5-lobed, the lobes equal, rounded, 1–2.5 × 1–2.5 mm, apex obtuse, puberulent; *corollas* pentamerous, imbricate, petals obovate to suborbicular, 3–4 × ca. 2 mm; *stamens* 5, inserted on margin of disk, 3–4 mm, alternate to petals; filaments 2–3 mm, anthers ca. 1 mm, disc black-punctate. *Ovary* 3-keeled, 3-celled, base embedded in the disc, ca. 1.5 mm long, style ca. 1.5 mm, glabrous, stigma 3-fid. *Fruits* sparsely puberulent, 3-winged, 1–1.2 × 1–1.7 cm, pale dull yellow to green-yellow with irregular reddish spots and blotches.

Distribution and ecology. *Wimmeria obtusifolia* is endemic to the Yucatán Peninsula and is known only from northern Yucatán and Quintana Roo states in Mexico. The species grows in low deciduous forest with an annual precipitation of 500–600 mm, ranging eastward into subcaducifolious medium-statured forests with an annual precipitation of 1100–1200 mm (Carnevali et al., 2003).

IUCN Red List category. *Wimmeria obtusifolia* can be classified as Endangered (EN) according to IUCN Red List criteria B1a,b (IUCN, 2001). It has been collected in three localities on a narrow belt of ca. 300 km along the central zone of Yucatán and northern Quintana Roo states. These localities are affected by high anthropogenic impact due to touristic developments (Quintana Roo) and by land-use changes resulting from agriculture and cattle ranching.

Discussion. *Wimmeria obtusifolia* was described by Standley (1930) in his *Flora of Yucatan*, from a collection of *G. F. Gaumer* (*24259*, MO) made between 1917 and 1921 from northern Yucatán. *Wimmeria obtusifolia* was referred by Lundell (1939) to subgenus *Wimmeriella*, despite the fact that fruiting material was unavailable. Because classifications of *Wimmeria*, at both the sectional and subgeneric levels, are essentially based on fruit characteristics, we propose an epitype above. The shape of the fruits collected recently supports the referral of *W. obtusifolia* to subgenus *Wimmeriella*. Some relevant litera-

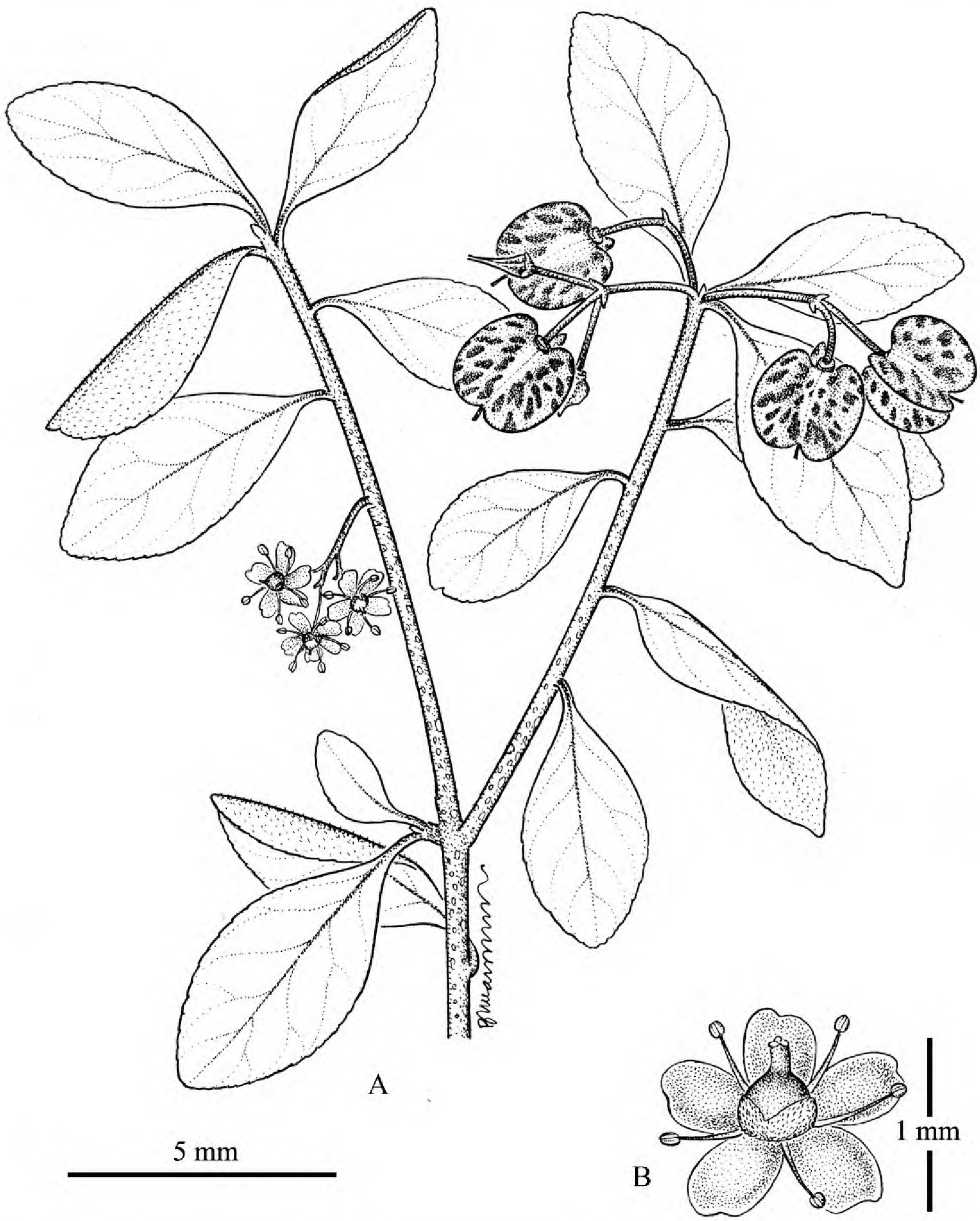

Figure 2. *Wimmeria obtusifolia* Standley —A. Habit with inflorescence and infrutescence branches. —B. Detail of flowers. Drawn from the epitype *G. Carnevali 7185* (CICY).

ture for the YPBP area treats the collections from Calakmul as *W. obtusifolia* (Durán et al., 2000; Martínez et al., 2001), but these collections are better referable to the new species, *W. lundelliana*.

Selected specimens examined. MEXICO. **Quintana Roo:** Mun. Solidaridad, 8 km S de Puerto Morelos, carr. Cancún–Chetumal, 20°47′50″N, 86°56′25″W, 0 m s.m., 22 ene. 1989 (fl.), *I. Olmsted 290* (CICY). **Yucatán:** Mun. Tetiz, Nohuayún, a 800 m de la Escuela Secundaria de Nohuayún, 20°57′41″N, 89°56′09″W, 15 m, 20 oct. 2006 (fl., fr.), *L. María Calvo s.n.* (CICY, MEXU, MO); Mun. Chicxulub, entre Chicxulub Puerto y Chicxulub Pueblo, 21°14′8.61″N, 89°31′58.13″W, 5–8 m, 13 nov. 2008, *G. Carnevali, R. Duno, J. C. Trejo & D.*

Angulo 7400 (BRIT, CICY, HUH, MEXU, MO, SEL, TEX, UCAM).

Acknowledgments. We thank Bruno Manara for the line drawings of *Wimmeria lundelliana* and *W. obtusifolia*. Luz María Calvo (CICY) prompted our interest in this genus after providing us with an excellent collection of *Wimmeria*, which proved to be the rediscovery of *W. obtusifolia*. Jorge Carlos Trejo Torres, of Ciudadanos del Karso, carefully read an earlier draft of the manuscript.

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Matelea quindecimlobata (Apocynaceae, Asclepiadoideae), a New Species from Amazonas, Brazil

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Abstract. *Matelea quindecimlobata* Farinaccio & W. D. Stevens, a new species of Asclepiadoideae, Apocynaceae, from Amazonas, Brazil, is described and illustrated. The most diagnostic aspect of this new species of *Matelea* Aublet s. str. is the lobed, then fimbriate outer margin of the outer corona.

Resumo. *Matelea quindecimlobata* Farinaccio & W. D. Stevens, uma nova espécie de Asclepiadoideae, Apocynaceae, do Amazonas, Brasil, é descrita e ilustrada. Apresenta a margem externa dos segmentos da corona lobado-fimbriada, característica diagnóstica, que a distingue das espécies relacionadas a *Matelea* Aublet s. str.

Key words: Amazonas, Apocynaceae, Asclepiadoideae, Brazil, IUCN Red List, *Matelea*.

Matelea Aublet (Asclepiadoideae, Apocynaceae) belongs to the New World subtribe Gonolobinae of the tribe Asclepiadeae, which can be distinguished within the subfamily by having the pollinia partially sterile and excavated on one or both faces and oriented more or less horizontally along the margin of the style apex (Stevens, 1988). The genus in the broad sense comprises about 300 species (Morillo, 1997) and is abundant and diverse in the tropical areas of the mainland of North and South America (Spellman, 1978). The southern Mexico–Guatemala region appears to be the center of diversity of the genus, with a possible secondary center in northern South America (Spellman & Dwyer, 1973). During the preparation of the treatment for the flora of the Ducke Reserve, Central Amazon, Brazil, one new species of *Matelea* was recognized and is here described and illustrated.

Matelea quindecimlobata Farinaccio & W. D. Stevens, sp. nov. TYPE: Brazil. Amazonas: Presidente Figueiredo, AM 210, Km 20, Igarapé da Onça, Corredeira da Pantera, 17 July 2008 (fl.), *M. A. Farinaccio, V. V. Scudeller & E. N. dos Santos-Silva 750* (holotype, SPF; isotypes, B, ESA, F, HRCB, HUEFS, INPA, K, MBM, MO, NY, RB, SP, SPF). Figure 1.

Haec species a *Matelea stenopetala* Sandwith et speciebus ei affinibus lobis coronae exterioris liberis lobulatis-fimbriatis differt.

Vines, twining to the right, older stems woody and covered with thick, ridged, spongy, fissured, tan-colored cork, young stems with inconspicuous mixed indumentum, long trichomes sparse, translucent, in 2 lines, patent, 0.3–0.4 mm, short trichomes dense, translucent, ca. 0.05 mm, glandular trichomes dense, pale brown, ca. 0.05 mm, glabrescent, internodes 6–20 cm. *Leaves* opposite, blades elliptic, 8–15 × 3–7.5(–9.3) cm, apex acute to acuminate, base obtuse to rounded, glabrous or with sparse short and glandular trichomes on midrib, lateral veins 4 to 8 pairs, diverging 55°–65° from midrib, colleters 1 to 6 at abaxial base; petiole 1.5–3 cm, with sparse mixed indumentum. *Inflorescence* congested-racemiform, peduncle 1–6 mm, with sparse mixed indumentum, becoming corky with age, axis 4–5 mm, covered with pedicel scars, pedicel 6.5–12 mm, with mixed indumentum or long trichomes absent, canaliculate when dry, bracts 0.7–1.1 × 0.4–0.7 mm, deltate to ovate, with dense short and glandular trichomes. *Calyx* divided to base, with 1 colleter per sinus, lobes elliptic, 1–1.9 × 0.8–1.1 mm, apex acute to rounded, green, sharply reflexed, with dense short and glandular trichomes outside, glabrous inside; corolla very briefly campanulate then rotate, white, drying with pale brown veins, adaxially glabrous, abaxially with inconspicuous short and glandular trichomes distally, tube 0.8–1.1 mm, lobes elliptic, 3–5 × 1.5–2.4 mm, apex rounded to acute, patent; gynostegium stipe 0.9–1.1 mm tall, corona of 2, 5-lobed, fleshy, glabrous skirts covering stipe of gynostegium, outer corona lobes 5, free, opposite anthers, dark colored when dry, base horizontal and overlapping the corolla

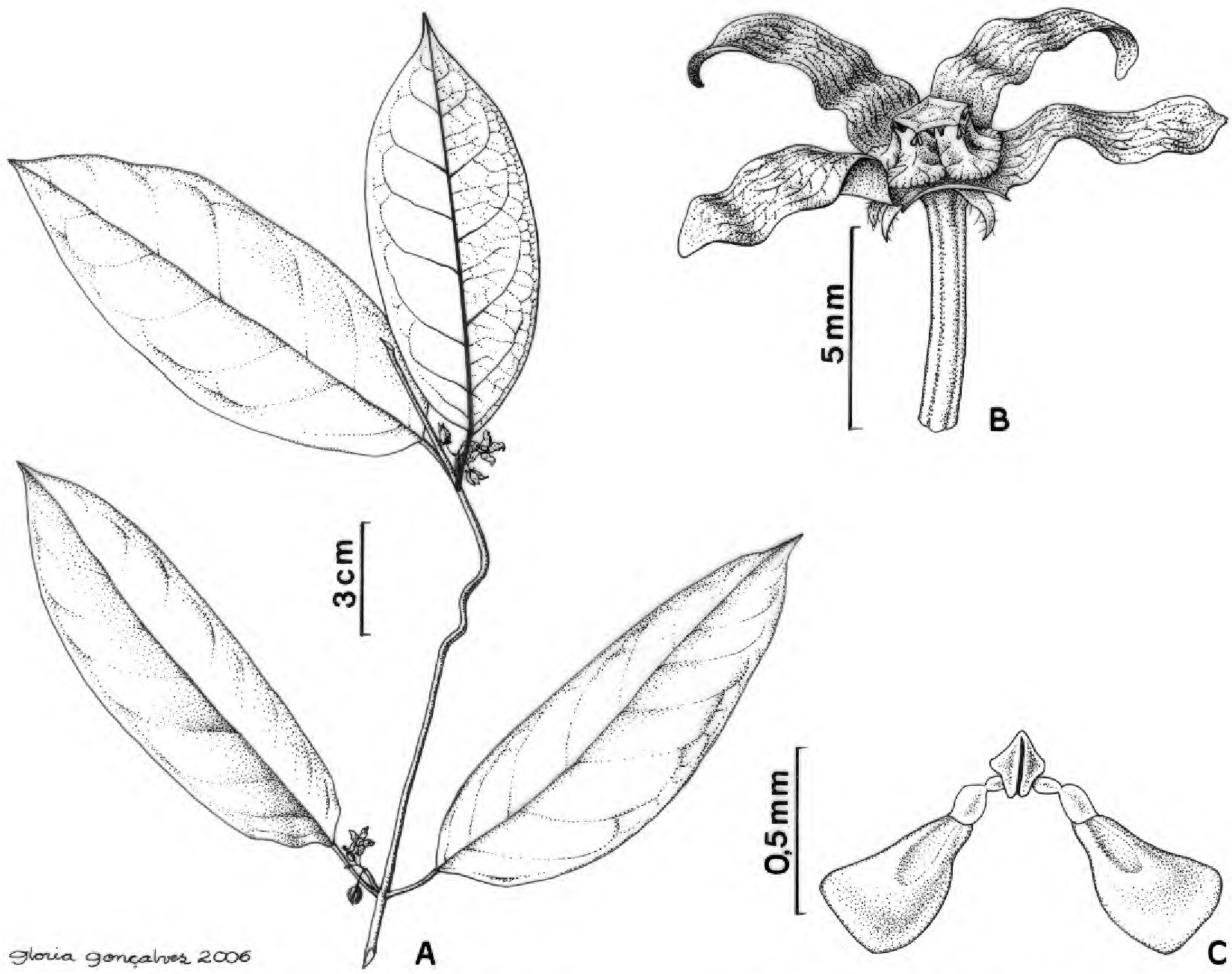

Figure 1. *Matelea quindecimlobata* Farinaccio & W. D. Stevens. —A. Flowering branch. —B. Flower with corolla lobe removed showing corona. —C. Pollinarium. Drawn from *Souza et al. 488* (INPA).

tube, each lobe trapezoidal in outline, outer margin deeply and irregularly 3- to 6-lobed-fimbriate with the lateral lobules broader than the central lobule(s), 0.4–0.5 × 0.9–1 mm, above the base a vertical lobule adnate to gynostegium stipe, this attenuate with tip touching anther base, 0.3–0.4 mm tall, inner corona lobes between erect outer corona lobules, elliptic, concave, 0.6–0.9 × 0.5–0.7 mm, terminal appendages appressed to margin of style apex, ca. 0.2 × 0.8–0.9 mm; corpusculum 0.14–0.19 × 0.08–0.09 mm, sagittate, pale brown, caudicles 0.05–0.1 × 0.06–0.08 mm, pollinia 0.33–0.46 × 0.22–0.25 mm, obovoid, sterile and deeply excavated on proximal half near center; style apex 1.8–1.9 mm wide, pentagonal, nearly circular, shallowly concave; ovaries smooth. *Follicles* and seeds unknown.

Distribution and habitat. *Matelea quindecimlobata* occurs in primary terra firme rainforest. The term terra firme is applied to all forests that are not seasonally flooded by the rivers. Different habitats can be recognized within what is called terra firme; forests of plateaus, slopes, white sands, and valley bottoms are defined mainly by the type of soil and this is associated with the variation in elevation and slope in the area (Ribeiro et al., 1999). The new species has been collected along streams in clearings (igarapé) in valley-bottom forest (baixio) that is characterized mainly by sandy soil, a waterlogged state during the wet season, and the accumulation of sediments.

IUCN Red List category. The new species occurs in Reserva Ducke, an area of protected primary forest, 25 km northeast of Manaus. *Matelea quindecimlobata* could be considered as Vulnerable (VU) under IUCN Red List criteria (IUCN, 2001), not only because the population is small, but also because it has a restricted distribution and has been found in places near Manaus that are prone to the effects of human activities, e.g., tourism (Cachoeira Baixa do Tarumã and Corredeira da Pantera).

Phenology. *Matelea quindecimlobata* is known to flower in April, July, August, October, and December.

Etymology. The specific epithet is an allusion to its corona, which is divided (radially) into five distinct lobes, and each of these lobes is more or less divided into three lobules.

Relationships. *Matelea quindecimlobata* belongs to a small group of species including the type of *Matelea*, *M. palustris* Aublet, and *M. stenopetala*, which are mostly restricted to riverine habitats in the Amazon Basin. These are shrubs or vines with prominent corky bark, a mixed indumentum, small flowers in indeterminate congested-racemiform inflorescences with closely spiraled scars, and a corona with the outer lobes horizontal at the base of the gynostegium stipe and the inner corona lobes adnate to the stipe. The other species of this group have the outer corona discoid, without free lobes, with the outer margin entire or at most pentagonal, while the new species has five free lobes that are then lobed again. *Matelea quindecimlobata* is probably most closely related to *M. stenopetala*.

Paratypes. BRAZIL. **Amazonas:** Manaus, Cachoeira Baixa do Tarumã, 1 July 1955 (fl.), *L. Coelho s.n.* (INPA 1293); Igarapé do Passapinho, 3 Aug. 1956 (fl.), *Dionísio s.n.* (INPA 4041, MO); Reserva Florestal Ducke, Manaus–Itacoatiara rd., Km 26, Acará trail, 24 Oct. 1974 (fl.), *G. T. Prance, T. D. Pennington & J. J. Ramos 23060* (INPA, MO, NY); 02°53′S, 59°58′W, Manaus–Itacoatiara, Km 26, 4 Dec. 1997 (fl.), *M. A. D. de Souza, L. H. P. Martins & P. A. C. L. Assunção 488* (INPA); 16 Apr. 1998 (fl.), *M. A. D. de Souza, P. A. C. L. Assunção, M. J. G. Hopkins & G. T. Prance 668* (INPA).

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Three New Species of *Indigofera* (Leguminosae) from China

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Abstract. Three new species of *Indigofera* L. (Leguminosae) are described from Sichuan and Yunnan provinces in China. *Indigofera shipingensis* X. F. Gao, known only from a single specimen collected in 1961 from Shiping County, Yunnan, has unifoliolate leaves and is most similar to *I. caloneura* Kurz from southern Yunnan and Southeast Asia. *Indigofera megaphylla* X. F. Gao, described from Yuanjiang County and also endemic to neighboring Shiping County in southern Yunnan, resembles *I. dichroa* Craib and *I. balfouriana* Craib from western to northern Yunnan, Sichuan, and southern Xizang, although these two species have much smaller leaflets. *Indigofera pseudoheterantha* X. F. Gao & Schrire is described from Sichuan County and occurs from the Daocheng to Miyi counties in southwestern Sichuan to the Zhongdian region of northwestern Yunnan, and appears closely related to *I. heterantha* Wallich ex Brandis from northwestern Yunnan to southern Xizang, westward to the Himalayas.

Key words: China, *Indigofera*, IUCN Red List, Leguminosae.

Indigofera L. is the third largest genus in Leguminosae with ca. 750 species, and 81 species were documented in the Chinese-language *Flora of China* (Fang & Zheng, 1994). In preparing the treatment of *Indigofera* for the English-language *Flora of China* (Gao & Schrire, 2009), several new species have come to light. Two new species were previously described by Gao (2007), and three new species are described here.

1. Indigofera shipingensis X. F. Gao, sp. nov. TYPE: China. Yunnan: Shiping Co., 21 Apr. 1961, *s. coll. 106* (holotype, KUN). Figure 1.

Haec species ab *Indigofera caloneura* Kurz foliolis utrinque trichomatibus adpressis brunneis medifixis vestitis, vexillo dorsaliter trichomatibus patulis lenibus albo-pubescente atque staminum vagina 6–7 mm longa differt.

Shrub; stems with dense adpressed brown biramous hairs. Leaves 1-foliolate, petiole 10–15 mm, usually with dense adpressed brown hairs, and fewer spreading hairs; stipules subulate, ca. 4 mm; leaflets oblong to elliptic-ovate, young leaf blades 3–4 × 2–2.5 cm, both surfaces with adpressed brown medifixed biramous hairs, abaxially canescent, lateral veins in 12 to 15 pairs; petiolules 2–4 mm, with adpressed biramous hairs; stipels 1.5–2.5 mm. Racemes 3.5–6 cm, including a peduncle 4–7 mm, densely flowered; bracts subulate, 1–1.5 mm; pedicels ca. 2 mm. Calyx ca. 2 mm, the lobes ± equaling the tube, densely hairy with adpressed spreading white hairs; corolla ca. 7 mm, standard obovate, dorsal surface densely spreading softly white pubescent; wings narrowly oblong, 1.6–1.8 mm wide, ciliate at the margin, keels densely spreading hairy at the apex, spur to 1 mm; staminal sheath 6–7 mm, anthers glabrous; ovary densely hairy with white adpressed biramous hairs. Fruits not seen.

Ecology and distribution. Since the only known specimen of this species was collected along a roadside in Yunnan, China, there is no further information on the ecological requirements of this species.

IUCN Red List category. *Indigofera shipingensis* is only known from the type collection made 47 years ago. Lacking a precise locality, the first author did not find this species in a spring 2008 expedition to Shiping County. An IUCN Red List assessment of Critically Endangered (CR) highlights the need for more information on this taxon (IUCN, 2001).

Etymology. The specific epithet refers to the type locality of Shiping County in Yunnan, China.

Discussion. *Indigofera shipingensis* is similar to *I. caloneura*, but its leaflets are pubescent on both surfaces (vs. adaxial surface glabrous in *I. caloneura*), the standard is white pubescent dorsally (vs. strigose

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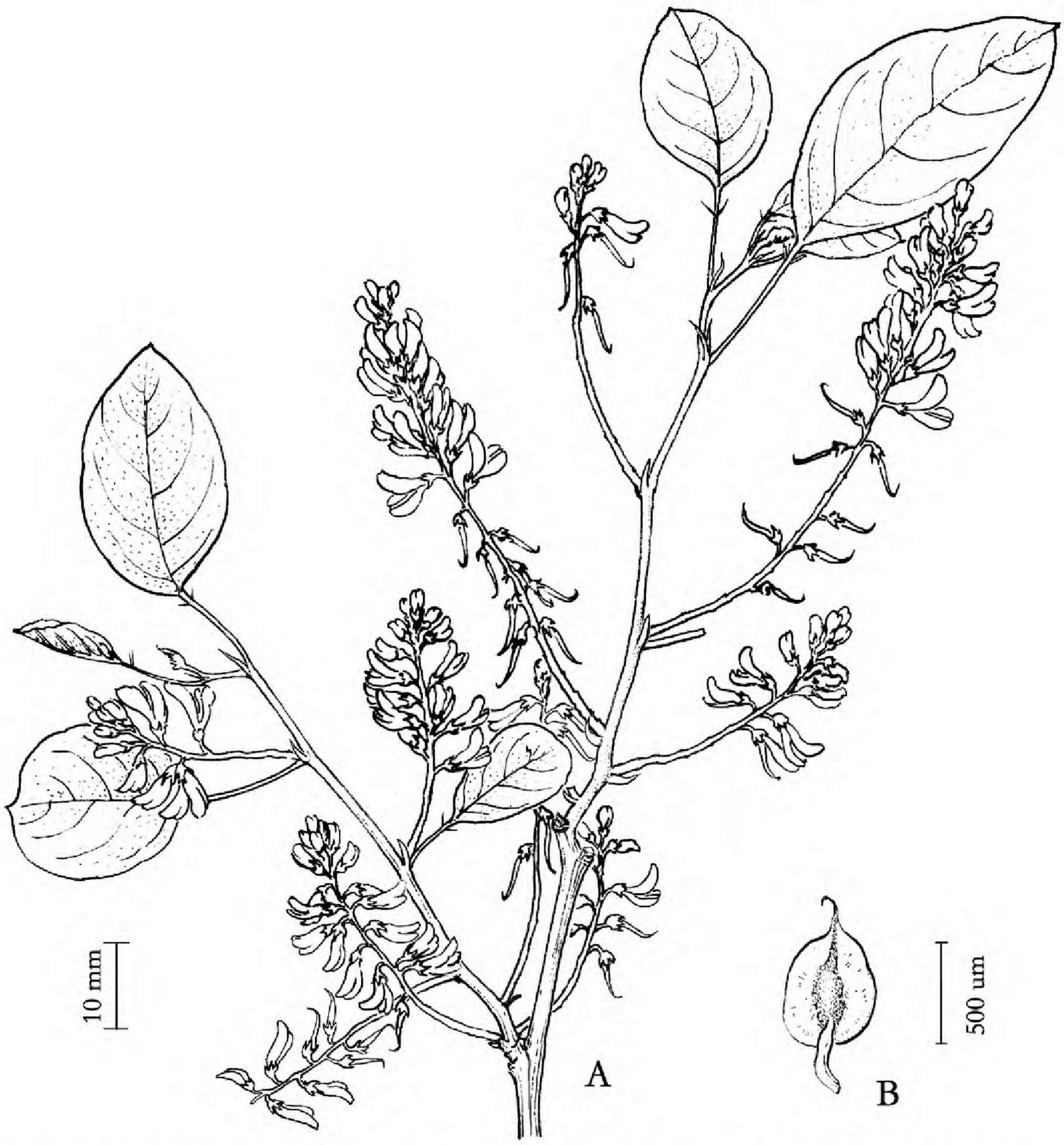

Figure 1. *Indigofera shipingensis* X. F. Gao. —A. Flowering branch. —B. Anther. Drawn by Jian Gu from the holotype *s. coll. 106* (KUN).

with stiff brown biramous hairs), and the staminal sheath is 6–7 mm long (vs. 8–10 mm).

2. Indigofera megaphylla X. F. Gao, sp. nov. TYPE: China. Yunnan: Yuanjiang Co., Wadi, 23°31′55″N, 102°16′44″E, 1575 m, 19 Apr. 2008, *Xin-Fen Gao & Bo Xu 10057* (holotype, CDBI; isotypes, CDBI, K, MO). Figure 2.

Haec species ab *Indigofera dichroa* Craib et *I. balfouriana* Craib foliolis majoribus utrinque sicut ramis petiolis pedunculisque dense patulo-pubescentibus, foliolorum venatione manifesta supra impressa infra prominente, racemis 5–13 cm longis atque pedunculis 3–5 mm longis differt.

Shrub 1–2 m tall; stems with dense spreading equally biramous brownish hairs. Leaves 12–15 cm, (1)3- to 5(7)-foliolate; petiole 30–50 mm, petiole and rachis terete, both with sparse brownish hairs; stipules narrowly triangular, 5–6 mm; leaflets oblong or ovate to obovate-oblong, 5–8 × 4–6 cm, abaxially with long white biramous hairs, adaxially with short spreading brownish biramous hairs, base rounded to cuneate, apex obtuse or emarginate, primary to tertiary venation markedly impressed adaxially and prominent abaxially, lateral veins in 9 to 14 pairs; petiolules 3–4 mm; stipels 2–3 mm. Racemes 5–13 cm, including a peduncle of 3–5 mm, peduncle and rachis with very

Figure 2. *Indigofera megaphylla* X. F. Gao. —A. Flowering branch. —B. Fruit. Drawn by Jian Gu from the holotype *Gao & Xu 10057* (CDBI) for A and *G. D. Tao 38875* (HITBC) for B.

dense spreading brown hairs; bracts ovate, ca. 2.5 × 1.2 mm, with adpressed hairs; pedicels 0.5–1 mm. Calyx 2.5–3 mm, the lobes narrowly triangular, ca. twice the length of the tube, densely spreading hairy; corolla purple, 7–8 mm, standard ovate-oblong, 4–4.5 mm wide, dorsal surface with densely spreading soft white hairs; wings narrowly oblong, 1.6–1.8 mm wide, ciliate at the margin, keels densely spreading white pubescent distally and along lower margin, spur to 1 mm; staminal sheath 5.5–6 mm, anthers glabrous; ovary densely pubescent with white and brown hairs. Pod (3–)4–5 cm, with densely spreading gray or pale

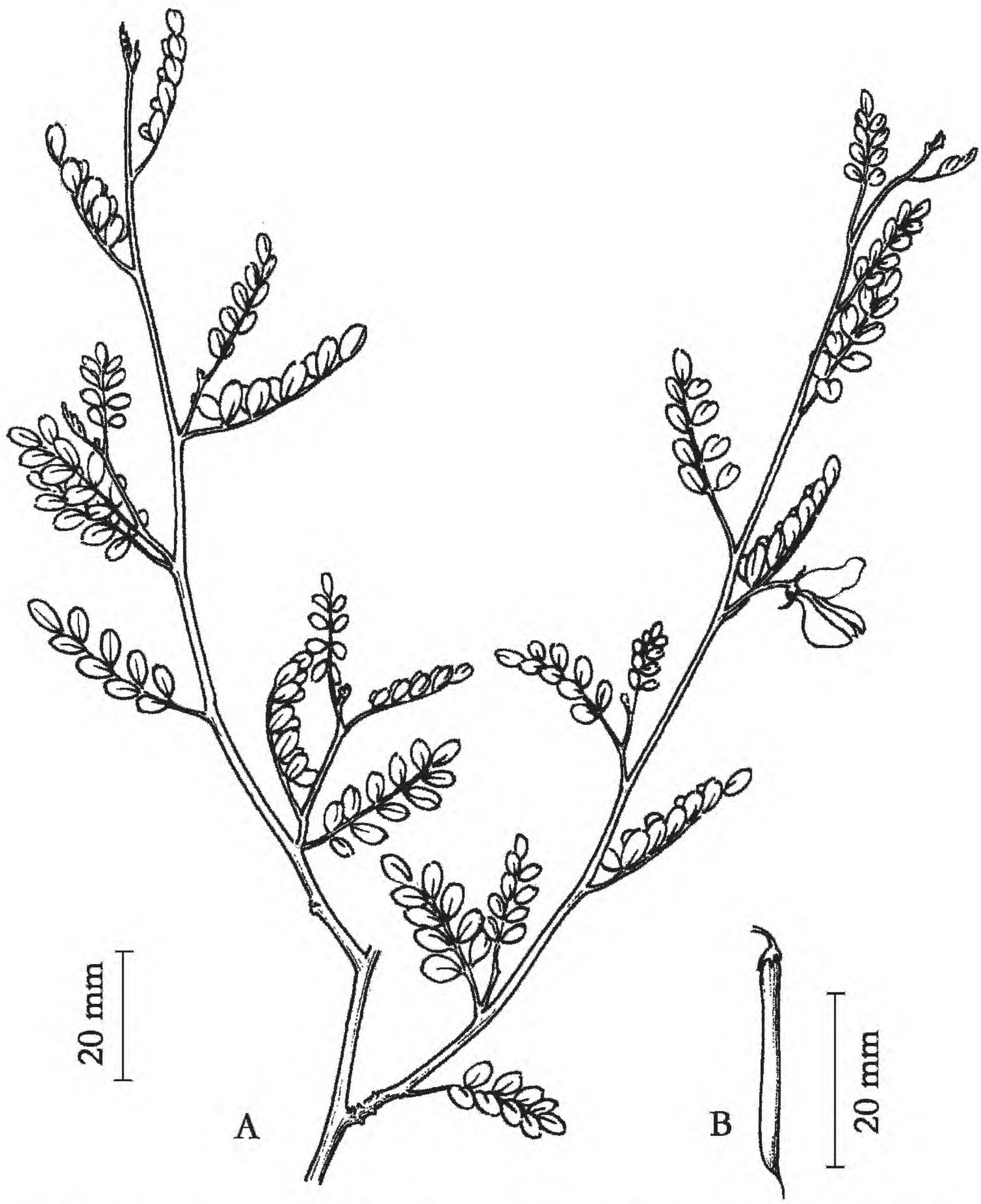

Figure 3. *Indigofera pseudoheterantha* X. F. Gao & Schrire. —A. Flowering branch. —B. Fruit. Drawn by Jian Gu from *J. Dong 28808* (CDBI) for A and the holotype *Veg. Exp. 29174* (CDBI) for B.

brown hairs, endocarp not blotched; seeds 9 to 12, dark brown.

Ecology and distribution. The new species occurs in Yunnan, China, growing in thickets and along roadsides between 1200 and 1600 m in elevation.

IUCN Red List category. *Indigofera megaphylla* is known only from a small area in two adjacent counties in southern Yunnan and grows commonly in thickets. The population size was estimated to number between 250 and 1000 mature individuals, and this species is best assessed as Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The specific epithet is from the Greek "megas," meaning "large," and "phyllon," meaning "leaf."

Discussion. *Indigofera megaphylla* is similar to *I. dichroa* and *I. balfouriana*, but these latter species have much smaller leaflets (1–4 cm vs. 5–8 cm long in *I. megaphylla*) and the secondary and tertiary venation is not impressed adaxially as in *I. mega-*

phylla. Both species have longer peduncles (5–15 mm vs. 3–5 mm long in *I. megaphylla*) and shorter racemes (2–6 cm vs. 5–13 cm long).

Paratypes. CHINA. **Yunnan:** Yuanjiang Co., Wadi, 1400 m, 7 June 1984, *Guo-Da Tao 38875* (HITBC); 1200 m, 7 June 1984, *Guo-Da Tao 38883* (HITBC); Shiping Co., Niujie, 1380 m, 9 Dec. 1988, *Ya Tang 88-34* (KUN).

3. Indigofera pseudoheterantha X. F. Gao & Schrire, sp. nov. TYPE: China. Sichuan: Daocheng Co., Riwa, Kanggu Village, 2860 m, 11 Aug. 1982, *Vegetation Exp. 29174* (holotype, CDBI). Figure 3.

Haec species *Indigofera heteranthae* Wallich ex Brandis affinis, sed ab ea stipulis triangularibus ca. 1 mm longis, foliis (5)7- ad 11(13)-foliolatis, stipellis absentibus, calyce ca. 2 mm longo atque staminum vagina 11–12 mm longa differt.

Shrub 0.2–3 m tall; stems ribbed, strigose with equally biramous adpressed minute white and scattered brown hairs. Leaves 1.5–3 cm, (5)7- to 11(13)-foliolate; petioles 4–7 mm, petiole and rachis with adpressed white hairs; stipules triangular, ca. 1 mm; leaflets elliptic to oblong, 4–9 × 2–4 mm, both surfaces with adpressed equally biramous white hairs but sometimes sparser adaxially, base cuneate or rounded, apex rounded to obtuse, lateral veins not visible; stipels absent. Racemes 1–4 cm, including a peduncle of ca. 10 mm, laxly 1- to 25-flowered; bracts 1–1.5 mm, subulate; pedicels 2–4 mm. Flowers 12–13 mm; calyx ca. 2 mm, lobes lanceolate to triangular, ± equaling or up to twice the length of the tube; corolla greenish and rose to purple; standard dorsal surface strigose with adpressed white hairs; wings ciliate at margin, keels with adpressed hairs at apex; staminal sheath 11–12 mm, anthers ovoid, mucronate, glabrous; style 4–5 mm. Young pods 2.5–3 cm, with minute adpressed hairs.

Ecology and distribution. This species is found in southwestern Sichuan and northwestern Yunnan, China, in sunny and dry brushland, grassland, open rocky areas, and near roadsides, from 1260 to 2900 m.

IUCN Red List category. During a 2007 field expedition, the first author observed the number of mature individuals to be fewer than 50 and noted that the species is extremely vulnerable to habitat change. Also taking into consideration extent of occurrence and habitat preference, *Indigofera pseudoheterantha* can be assessed as Critically Endangered (CR) according to IUCN Red List criteria (IUCN, 2001).

Etymology. This species epithet refers to its resemblance to *Indigofera heterantha*.

Discussion. Indigofera pseudoheterantha differs from *I. heterantha* in having triangular stipules ca. 1 mm long (vs. stipules linear-attenuate and 2–6 mm in *I. heterantha*), stipels absent (vs. present), leaves (5)7- to 11(13)-foliolate (vs. 13- to 25-foliolate), calyx ca. 2 mm long (vs. 2.5–4 mm), and staminal sheath 11–12 mm long (vs. 8–10.5 mm).

Paratypes. CHINA. **Sichuan:** Xiangcheng Co., Yuejin Xiang, Heida village, near Shuoqu River, 24 July 1982, *Jian Dong 28808* (CDBI); Miyi Co., Wanqiu, 31 July 2007, *Xin-Fen Gao, Xiao-Mei Wei & Bo Xu 9748* (CDBI). **Yunnan:** Zhongdian (Chungtien) Plateau, July 1914, *G. Forrest 12602* (E, K).

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Eleocharis tenarum (Cyperaceae), a New Species from Durango and Zacatecas, Mexico

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Abstract. *Eleocharis tenarum* S. González & M. González (Cyperaceae), an endemic to dry temperate forests in Mexico, is described from Zacatecas and Durango. It belongs to *Eleocharis* R. Brown sect. *Eleocharis* subser. *Truncatae* Svenson s.l. and can be recognized by its basally burgundy to rose-purple upper sheaths with oblique, not truncate or cuspidate apex, and its dark brown achenes that are finely reticulate with longitudinally elongated cells.

Resumen. Se describe *Eleocharis tenarum* S. González & M. González (Cyperaceae), nueva especie endémica de bosques de clima templado seco de los estados de Durango y Zacatecas, México. Forma parte de *Eleocharis* R. Brown sect. *Eleocharis* subser. *Truncatae* Svenson s.l. y se reconoce por sus vainas superiores basalmente de color rojo-vino a rosa-púrpura, con ápice oblicuo, no truncado ni cuspidado, y por su aquenio de color café oscuro finamente reticulado con celdillas longitudinalmente alargadas.

Key words: Durango, *Eleocharis*, IUCN Red List, Mexico, Zacatecas.

Eleocharis R. Brown (Cyperaceae) includes a wide diversity of groups (González & Peterson, 1997; González & Tena, 2000). No recent comprehensive worldwide taxonomic treatment of *Eleocharis* is available (Smith et al., 2002), and many species remain undescribed in Latin America. The subseries *Truncatae* Svenson (Svenson, 1932) includes species with the apex of the upper sheath truncate and usually cuspidate as well as other plants similar to the typical *Truncatae* in most aspects, but having the apex of the upper sheath oblique and not cuspidate. The species here described belongs to subseries *Truncatae* in this broad sense.

Eleocharis tenarum S. González & M. González, sp. nov. TYPE: Mexico. Zacatecas: Mpio. Sombrerete, Parque Nac. Sierra de Órganos, por vereda hacia la cascadita, en sitio arenoso cerca de arroyo, en bosque de *Pinus cembroides* y *Quercus*, 23°46′23″N, 103°47′38″W, 2350 m, 9 Aug. 2003, *S. González 6808 con Georgina Tena* (holotype, CIIDIR; isotypes, ENCB, IEB, MEXU, MO). Figure 1.

Eleochariti albibracteatae Nees & Meyen ex Kunth affinis sed ab ea caulibus altioribus, vagina superiore ad basim rubro-vinosa usque roseo-purpurea, spicula lanceolata pluriflora et achenio leviter reticulato differt; *E. dombeyanae* Kunth et *E. parishii* Britton similis sed ab eis vaginae superioris apice obliquo absque cuspide, achenio reticulato et stylobasi conica differt.

Perennial, loosely caespitose, from ascendant to nearly vertical rootstocks from a horizontal rhizome; culms erect, somewhat stiff, 8–24(–31) cm × 0.6–0.9 mm, quadrangular and deeply sulcate or several-ridged, usually compressed, 0.3–0.4 mm thick, pale green, shiny. Basal sheaths loose, scarious, stramineous to pale purple-tinged, subtruncate to slightly oblique and rounded at the apex, easily disintegrating and often absent in herbarium specimens; upper sheath tight, cylindric, 1.2–4 cm, proximally deep burgundy to rose-purple or purple-striolate, distally pale green or stramineous, the apex of the upper sheath oblique and acute or slightly oblique and rounded at the apex, the mouth truncate to concave, the margin membranous, stramineous and minutely red-dotted or ± firm and callous, reddish or purple, lacking a cusp but sometimes the dorsal vein prolonged into a mucro not reaching the margin of the sheath or surpassing it by only 0.1–0.2 mm. Spikelets lanceoloid to ovoid-lanceoloid or narrowly fusiform, often somewhat compressed, 4.1–9.5 × 1.8–

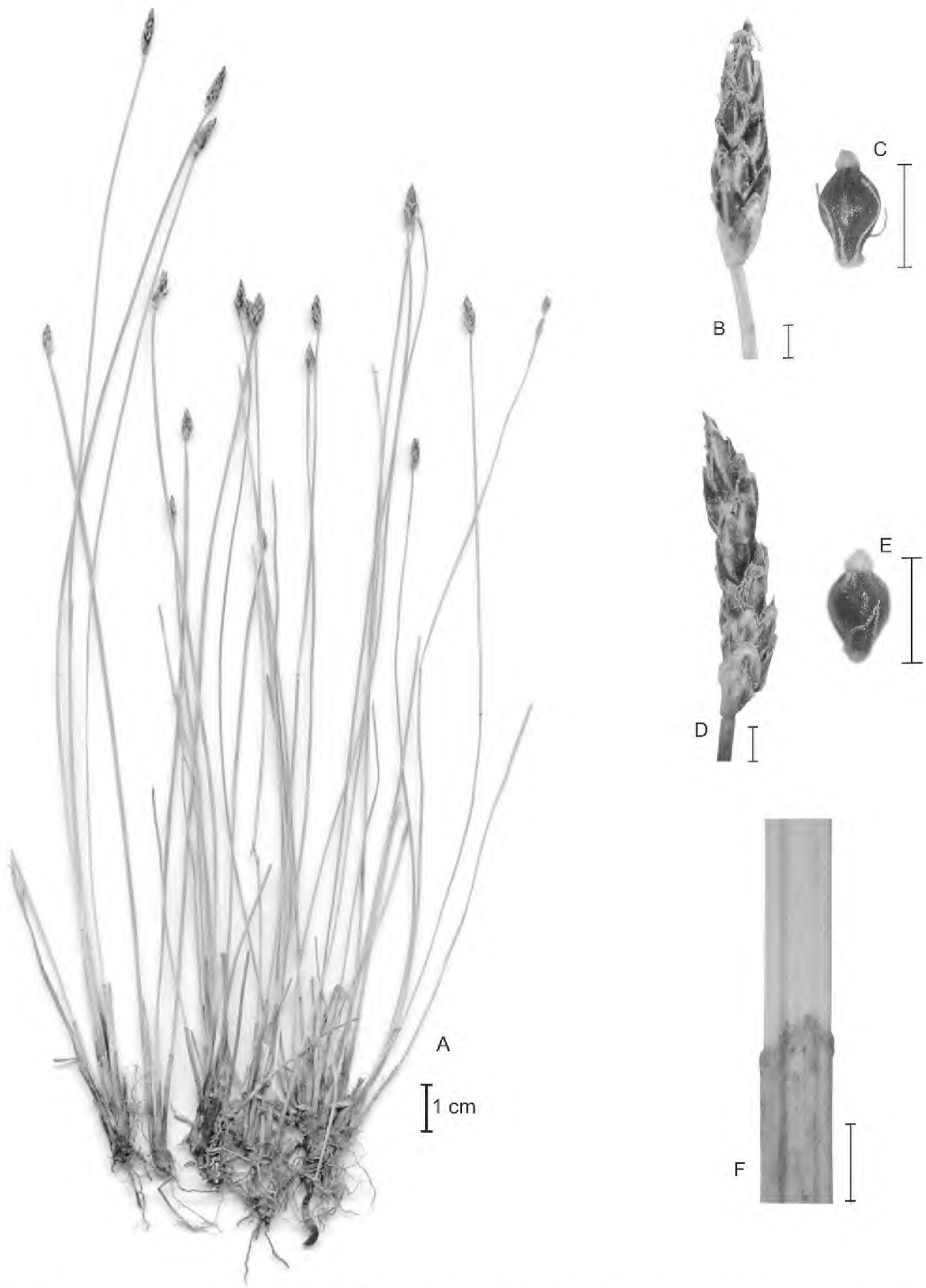

Figure 1. *Eleocharis tenarum* S. González & M. González. —A. Habit. —B. Spikelet. —C. Achene. —D. Spikelet. —E. Achene. —F. Upper portion of distal leaf sheath. (A–C, F from the type *S. González et al. 6808*; D from *S. González et al. 6020*; E from *S. González et al. 6416*.) Scale bars: A = 1 cm; B–F = 1 mm.

2.3 mm, acute to subacuminate, rachilla 0.3–0.4 mm wide, ca. 13- to 26-flowered; floral scales polystichous, loosely arranged, appressed or subappressed, (2.2–)2.3–2.7 mm, 0.5–0.8 mm wide in lateral view, narrowly ovate, obtuse to acute, the midvein stramineous or reddish, the flanks membranous, burgundy to red-purple, the margins and apex scarious, colorless, hyaline, cellulose-reticulate, 0.1–0.3 mm long; lowermost scale empty, amplexicaulous in immature spikelets, later subamplexicaulous, ovate, 1.8–2.4 mm, 1/5–1/3 the length of the spikelet, the apex translucent, to 0.8 mm, rounded to broadly acute; subprox-

imal scale empty or with flower. Perianth present, of ca. 5 to 7 erect bristles appressed to achene, quite variable in length, 0.1–1 mm, shorter than achene or equaling the achene body, colorless or slightly reddish brown, translucent, retrorsely scabrous with colorless irregular spines; style trifid; stamens 3, filaments 1.9–2.2 mm, not or barely exserted, colorless to pale reddish brown, anthers 1.1–1.3(–1.5) mm, yellow, the connective shortly prolonged. Achene 1–1.2(–1.3) mm including base and tubercle, the body (0.8–)0.9–1 × (0.65–)0.7 mm, trigonous with blunt slightly costulate angles and convex sides, obovoid to obpyriform in outline, chocolate to reddish or dark brown, finely striate-reticulate with many rows of longitudinally elongated cells, appearing nearly smooth to somewhat irregular, glossy, when immature yellow or lemon-green, reticulate and dark striolate; stylobase pyramidal to deltoid, slightly spongy, whitish, sometimes reddish brown, acute or minutely denticulate at the summit, contrasting with the color of the body of achene, 0.2–0.3 × 0.2–0.3 mm at the base.

Distribution and habitat. *Eleocharis tenarum* is known from southern Durango and Zacatecas, Mexico, on low mountains and on the eastern side of the Sierra Madre Occidental. It grows in patches in open, sandy or gravelly sites on igneous rocks between 2300 and 2700 m.s.m., in areas that may temporarily flood but that are dry most of the year. It is found in dry forests (*Pinus cembroides* Zuccarini and *Quercus* L.) or in semi-humid *Quercus–Pinus* L. forests, often associated with annual herbs, mainly *Tagetes micrantha* Cavanilles and *Muhlenbergia* Schreber.

IUCN Red List category. *Eleocharis tenarum* should be considered Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001) given its restricted, patchy distribution, habitat degradation by overgrazing practices, and the rapid changes that are occurring in the temperate forests of the region.

Etymology. It is a pleasure to dedicate this species to Georgina A. Tena-González and Sandra M. Tena-González, daughters of two of the authors (MSGE and JATF). They have enthusiastically participated in many botanical surveys of the CIIDIR herbarium, including the collection of the type of this species.

Discussion. *Eleocharis tenarum* belongs in *Eleocharis* subg. *Eleocharis* sect. *Eleocharis*. In its general aspect, it is morphologically similar to Mexican representatives of subseries *Truncatae*, especially *E. dombeyana* and *E. parishii*, from which *E. tenarum* differs in the oblique, nontruncate and noncuspidate apex of the upper sheath, the burgundy to rose color of the upper sheath, the achene that is finely reticulate with longitudinally elongated cells, and the conic, not mucronate or lanceolate stylobase. From *E. montevidensis* Kunth and *E. ignota* S. González & Reznicek, it differs in the apex of the upper sheath, the shape and color of the spikelet and floral scales, and the more finely reticulate achene. *Eleocharis tenarum* appears to be related to the complex of *E. albibracteata* in the similar apex of the upper sheath, but it differs mainly in its longer culms, longer and narrower spikelets with more flowers, longer proximal floral scale, and the more finely reticulate, bumpy achene. A comparison of these species is presented in a key.

KEY TO *ELEOCHARIS TENARUM* AND MORPHOLOGICALLY RELATED SPECIES

1a. Apex of the upper sheath oblique and acute or slightly oblique and rounded at the apex, membranous to slightly callous, without a cusp, sometimes a mucro 0.1–0.2 mm present 2
  2a. Culms deeply sulcate; base of the upper sheath deep burgundy to rose-purple or purple-striolate; spikelets lanceoloid to ovoid-lanceoloid or narrowly fusiform, 13- to 26-flowered; floral scales burgundy to red-purple; achene (0.65–)0.7 mm wide, finely striate-reticulate with longitudinally elongated cells (30×). . . . . *E. tenarum*
  2b. Culms slightly sulcate; base of the upper sheath purple or brown; spikelets ellipsoid to subfusiform, 2- to 8-flowered, floral scales reddish brown to almost black, colorless when immature; achene 0.7–0.9 mm wide, reticulate (30×) . . . . . *E. albibracteata*
1b. Apex of the upper sheath truncate to very slightly oblique, callous, with a cusp (0.1–)0.5–2 mm long. 3
  3a. Rhizomes thick, ligneous, not creeping; cusp on apex of the upper sheath (0.5–)0.8–2 mm long, 0.1–0.2 mm wide at the base . . . . . *E. ignota*
  3b. Rhizomes slender, creeping; cusp on apex of the upper sheath 0.1–1.2 mm long, 0.2–0.3 mm wide at the base 4
    4a. Spikelets ovoid, ellipsoid, or subcylindrical; apex of floral scales broadly rounded, usually horizontally wrinkled; achene surface coarsely reticulate, appearing subcancellate (30×); stylobase pyramidal to deltoid, 0.1–0.3 mm long . . . . . *E. montevidensis*
    4b. Spikelets ovoid, narrowly lanceoloid, or cylindric, acute to subacute; apex of floral scales rounded to acute, not wrinkled; achene surface almost smooth to reticulate (30×); stylobase mucroniform to lanceoloid, 0.2–0.5 mm long 5
      5a. Floral scales dark purple to almost black; achene broadly obovoid to obpyriform, 0.7–1 mm wide, nearly smooth (30×) . . . . . *E. dombeyana*
      5b. Floral scales brown to purple; achene ellipsoid or obovoid to narrowly obpyriform, 0.5–0.7 mm wide, reticulate (30×) . . . . . *E. parishii*

Paratypes. MEXICO. **Durango:** Mpio. Durango, Km 51.2 carr. Durango–Mazatlán, 23°54′37″N, 104°58′50″W, 3 Sep. 1997, *S. González 6020 con S. Acevedo* (ANSM, CIIDIR, IEB, MEXU, MICH, NMSU); Mpio. Súchil, Res. Biosfera La Michilía, Mesa El Burro, 23°24′N, 104°17′W, 18 Sep. 1985, *S. González 3221* (CIIDIR, IEB, MEXU). **Zacatecas:** Mpio. Sombrerete, Parque Nac. Sierra de Órganos, mesita, ca. 0.7 km al S de la entrada al parque, 23°46′45″N, 103°47′26″W, 22 Sep. 2001, *S. González 6416 con D. Enríquez, M. Adame y L. Chávez* (CIIDIR, ZAC).

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A New Species of *Elymus* (Gramineae, Triticeae) from Eastern Australia

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Abstract. A new species, *Elymus fertilis* Song Wang ex S. W. L. Jacobs & Barkworth (Gramineae, Triticeae), is described from New South Wales and Queensland, Australia, with a New South Wales specimen being designated as its holotype. *Elymus fertilis* is similar to *E. multiflorus* (Banks & Solander ex Hooker f.) Á. Löve & Connor, but differs in having longer awns on the lowest lemma of the spikelet and in growing mostly on basic soils of volcanic origin, whereas *E. multiflorus* is more common on alluvial soils. A key is supplied for the Australian species of *Elymus*.

Key words: *Elymus*, Gramineae, IUCN Red List, Poaceae, Triticeae.

For a long time, only one species of what is now treated as *Elymus* L. was recognized in Australia, *E. scaber* (R. Brown) Á. Löve or, as it used to be called, *Agropyron scabrum* (R. Brown) P. Beauvois. This species was, however, known to be diverse (see, e.g., Rees, 1972) and was frequently referred to as a complex. With further study, additional taxa have been recognized. Thus, in 1989 Stanley and Ross recognized three taxa in southeastern Queensland: two species, *E. scaber* and *E. multiflorus* (Banks & Solander ex Hooker f.) Á. Löve & Connor, and two subspecies, *E. scaber* var. *scaber* and *E. scaber* var. *plurinervis* (Vickery) B. K. Simon. Subsequently, Wang and Henwood (1999) recognized one additional species, *E. rectisetus* (Nees in Lehmann) Á. Löve & Connor, as growing in Australia. In her doctoral thesis, however, Wang (1999) recognized variety *plurinervis* at the species level and documented the existence of a hitherto unrecognized species for which she suggested the epithet "fertilis." Two of the specimens that she cited as belonging to this new species, *Wang 95140* and *95158*, are cited as *E. multiflorus* in Wang and Henwood (1999).

Wheeler et al. (2002) and Wang and Jacobs (2002) followed the recommendations Wang (1999) made in her thesis, recognizing the two species as species A and B, with species A corresponding to *Elymus scaber* var. *plurinervis* and species B to the new taxon. More recently, Connor (2005) raised *E. scaber* var. *plurinervis* to specific rank, naming it *E. plurinervis* (Vickery) Connor, a decision that is well supported by morphological information (Murphy & Jones, 1999). This paper concerns species B, the previously unrecognized taxon. We are convinced that it merits recognition as a distinct species on the basis of its morphological, ecological, and molecular distinction from other species in the *E. scabrus* complex (Wang, 1999; Wang & Jacobs, 2002). To reduce the confusion resulting from its lack of a name and to provide a name for the next edition of Wheeler et al. (2002), we describe it here, using the epithet *fertilis* as suggested by Wang (1999), and provide a key to all the Australian species of *Elymus* to aid others in identifying them.

Elymus fertilis S. Wang ex S. W. L. Jacobs & Barkworth, sp. nov. TYPE: Australia. [New South Wales]: urban area, Moree, 29°28′S, 149°51′E, 13 Oct. 1988, *N. Lloyd 759* (holotype, NSW 220373). Figure 1.

Elymo multifloro (Banks & Solander ex Hooker f.) Á. Löve & Connor similis sed ab eo spiculae lemmate infimo plerumque arista longiore et lemmatibus supernis arista longiore quam corpore munitis differt.

Caespitose perennial to ca. 55 cm tall; culms erect or drooping, 0.7–1.7 mm diam., glaucous, 3- to 6-noded. Basal leaf sheaths glabrous or hairy, smooth; margins hyaline or membranous; auricles 0–1.9 mm, glabrous; ligules 0.4–0.5 mm, membranous, truncate; collar glabrous or hairy; blade flat, to ca. 20 cm × 1.8–4.7 mm, adaxially glabrous or scabrous or hairy, abaxially glabrous or scabrous. Inflorescence axis 21–70 cm; peduncles glabrous or scabrous; internodes 20–38 mm, glabrous or scabrous. Spikelets 5 to 10 on the rachis, solitary at each node, the flat side against the axis, 26–39 mm, with 4 to 9 florets, the spikelets

Figure 1. *Elymus fertilis* S. Wang ex S. W. L. Jacobs & Barkworth. —A. Habit. —B. Callus as viewed from both sides. —C. Expanded view of spikelet showing shorter awns on lower lemmas. —D. Intact spikelet. —E. Palea, adaxial view, showing exserted stamens. —F. Floret in side view showing developing ovary. Drawn from the holotype *Lloyd 759* (NSW220373). Scale bars: A = 8 cm; B = 0.4 cm; C, D = 1 cm; E, F = 0.6 cm.

± equal to the internode length; glumes subequal; lower glume 4.8–6.1 × 0.8–1.2 mm, glabrous or scabrous, 4- to 5-nerved, with a terminal awn 1–1.8 mm and membranous margin 0.3–0.6 mm wide; upper glume 5.6–7 × 0.7–1.2 mm, glabrous or scabrous, 4- to 6-nerved, with a terminal awn 1–1.5 mm, and margins hyaline or membranous, 0.3–0.5 mm wide; rachilla segments 1.8–2.5 mm, with

short hairs; apical scar ovate, obovate to circular; callus 0.6–0.9 mm, broadly triangular, dorsal surface flat or sunken, glabrous or glabrescent, tip not thickened, adaxial margin thickening, extending approximately to the midpoint; lemmas 8.5–10 mm, dorsally glabrous or scabrous, not pruinose, 5-nerved; margins hyaline or membranous, 0.1–0.3 mm wide; apex acuminate, flat, entire or bifid, awned; awn on lowest lemma in each spikelet 2–7.7 mm, those on other lemmas 4.4–15 mm, all awns remaining straight, when dry, scabrous, 3-nerved at base; palea 8–9.1 × 1–1.4 mm, 2-keeled; keels ciliolate with hairs 0.1–0.18 mm; intercostal region scabrous or hairy; apex narrower to wider than lemma apex, truncate or obtuse, entire or retuse, side panels 0–0.27 mm shorter than the keel tips; lodicules 0.9–1.4 mm, margin lobed or entire; stamens 3; anthers 1.6–2.6 mm, yellow or purple. Caryopsis narrowly elliptical or narrowly oblong, 5.2–6.7 × 1–1.3 mm, longitudinally grooved or deeply furrowed.

Distribution and habitat. *Elymus fertilis* grows in southeastern Queensland and northern New South Wales. It usually grows on dark brown basaltic soils of volcanic origin, but is sometimes found on fertile alluvial soils. It grows in mixed populations with *E. plurinervis* in New South Wales, but not in Queensland. *Elymus multiflorus* usually grows on poorer soils in more coastal and riverine areas and is much more common farther south, extending through New South Wales, Victoria, and Tasmania.

IUCN Red List category. The new species is now almost completely confined to roadsides. Most of its natural distribution is on high-fertility soils that originally supported grasslands or grassy woodlands. It is estimated that well over 50% of such land has been lost to cultivation. While the cause of the loss is clear, it has not ceased, and most of the known populations are vulnerable. The data best fit the IUCN (2001) classification for Endangered (EN).

Etymology. The epithet *fertilis* was suggested by Wang (1999) because of the high seed set the species exhibits.

Reproductive biology. The high seed set, which is retained in cultivation (pers. obs.), strongly suggests that *Elymus fertilis* reproduces sexually (Connor, 1954; Murphy & Jones, 1999). In this, it resembles both *E. multiflorus* and *E. plurinervis* but differs from *E. scaber* s. str. and *E. rectisetus*.

Cytology and genomic constitution. *Elymus fertilis* is probably a hexaploid with $2n = 42$ and a genomic constitution of StYW. (Genome designations follow the recommendations of the International Triticeae Consortium [1996+].) Chromosome counts and genomic analyses have been made for several accessions in the *E. scaber* complex (Torabinejad et al., 1987; Torabinejad & Mueller, 1993), all of which were demonstrated to be hexaploids with a genomic constitution of StYW. According to the authors, the taxa studied include what are here called *E. plurinervis*, *E. rectisetus*, and *E. scaber*, although Connor (1994) noted that he would call one of the accessions identified as *E. scaber*, D2888, *E. multiflorus*. Torabinejad and Mueller (1993) cited the United States Department of Agriculture's Plant Introduction numbers for the accessions they studied, but no voucher specimens were cited. Consequently, we have not been able to verify any of the identifications. Nevertheless, it seems probable that *E. fertilis* resembles other members of the *E. scaber* complex in chromosome number and genomic constitution.

Molecular analysis. Random amplified polymorphic DNA analysis (Wang & Jacobs, 2002) revealed 11 markers unique to *Elymus fertilis*, only slightly fewer than the 13 markers unique to *E. plurinervis*.

Paratypes. AUSTRALIA. **New South Wales:** North Western Plains, Moree, 7 May 1997, *M. Murphy 4317* (NE). **Queensland:** betw. Laidley & Forest Hill, 28 Nov. 1930, *C. E. Hubbard 5311* (MEL, NSW); Ascot, Brisbane, 13 Aug. 1930, *C. E. Hubbard 3654* (BRI, MEL, NSW); Cheribah turn-off, Warwick-Killarney rd., 25 Nov. 1985, *J. G. Carmen 1025 & B. K. Simon* (NSW); Wallangara, 2 Jan. 1933, *S. T. Blake 4414* (NSW).

KEY TO *ELYMUS* IN AUSTRALIA

N.B. *Elymus repens* (L.) Gould is sometimes placed in a separate genus, *Elytrigia* Desvaux.

1a. Plants with long, pale yellow vigorous rhizomes; lemmas acute but awnless (in Australia). . . . *E. repens*
1b. Plants caespitose; at least some lemmas usually awned 2
2a. Rachilla hairs usually 0.2–1 mm long; callus usually triangular to narrowly triangular, usually distinctly hairy 3
2b. Rachilla hairs < 0.2 mm; callus broadly triangular, glabrous to glabrescent. 4
3a. Rachilla hairs usually not covering callus base; dorsal surface of callus flat to sunken; callus usually hairy on margins and surface sometimes glabrous to glabrescent; callus tip usually thickened . . . . . *E. scaber*
3b. Rachilla hairs covering callus base; dorsal surface of callus rounded; callus hairy only on the margins; callus tip not thickened . . . . . *E. rectisetus*
4a. Glumes ≥ 7.7 mm; lemma awn usually curved when dry, 1-nerved at base; mature caryopsis < 55% palea length . . . . . *E. plurinervis*
4b. Glumes usually < 7 mm; lemma awn straight when dry, 3-nerved at base; mature caryopsis > 60% palea length 5
5a. Awn of lowest lemma 2–7.7 mm; other lemma awns 4.4–15 mm; ratio of awn to lemma length 0.7–1.3:1 . . . . . *E. fertilis*

5b. Awn of lowest lemma 0–3 mm; other lemma awns 0–11 mm long; ratio of awn to lemma length 0.2–0.8:1 . . . . . *E. multiflorus*

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Begonia caparaoensis (Begoniaceae), a New Endemic Species from the Atlantic Forest in the State of Minas Gerais, Brazil

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Abstract. A new narrow endemic species of *Begonia* L. (Begoniaceae) from the Atlantic Forest of Brazil is described and illustrated. *Begonia caparaoensis* E. L. Jacques & L. Kollmann occurs in a small area of Cachoeira Bonita, along the coast of the José Pedro River (20°24′29″S, 41°50′29″W), at the Parque Nacional do Caparaó, Minas Gerais, Brazil, growing on rocky outcrops. Diagnostic characters, description, detailed illustration, and taxonomic comments are given. *Begonia caparaoensis* resembles *B. jureiensis* S. J. Gomes da Silva & Mamede, which shares its peltate leaf blades, bilamellate placentae, and obovate anthers, but is easily distinguished by its leaves with serrulate margins (vs. dentate) and its smaller stipules (ca. 7 × 9 mm vs. ca. 3 × 1.5 cm). *Begonia caparaoensis* is identified as Critically Endangered (CR B2a) according to IUCN Red List criteria.

Resumo. Uma nova espécie de *Begonia* L. (Begoniaceae) endêmica da Mata Atlântica do Brasil é descrita e ilustrada. *Begonia caparaoensis* E. L. Jacques & L. Kollmann ocorre num pequeno trecho da Cachoeira Bonita, às margens do Rio José Pedro (20°24′29″S, 41°50′29″W), no Parque Nacional do Caparaó, Minas Gerais, Brasil, crescendo em formações rochosas. Caracteres diagnósticos, descrição, ilustração detalhada e comentários taxonômicos são apresentados. *Begonia caparaoensis* assemelha-se a *B. jureiensis* S. J. Gomes da Silva & Mamede, com a qual compartilha a lâmina foliar peltada, a placenta bilamelada e as anteras obovadas, mas é facilmente distinta pelas folhas com margem serrulada (vs. dentada) e pelas estípulas menores (ca. 7 × 9 mm vs. ca. 3 × 1.5 cm). *Begonia caparaoensis* é incluída na categoria Criticamente em Perigo (CR B2a) de acordo com os critérios da IUCN.

Key words: Atlantic Forest, *Begonia*, Begoniaceae, Brazil, IUCN Red List.

The genus *Begonia* L. (Begoniaceae) has approximately 1400 named species distributed primarily in the tropical and subtropical areas of the world, and within this area is absent only from Australia (Forrest & Hollingsworth, 2003; Clement et al., 2004; Forrest et al., 2005). It is well represented in Brazil, with approximately 200 species, and is found in almost all ecosystems except mangroves. In Brazil, one of the centers of distribution of the genus is the Atlantic Forest (Jacques, 1996; Gomes Silva & Mamede, 2000; Jacques & Mamede, 2004, Souza & Lorenzi, 2005). This genus is morphologically variable (Jacques & Mamede, 2005) but can be characterized by its often asymmetric leaf shape, four staminate tepals and five pistillate tepals, an inferior ovary with axilar placentation, dry 3-winged fruit, and seeds with a lid and collar cells.

Research in the GFJP herbarium and fieldwork in the Parque Nacional do Caparaó in the state of Minas Gerais revealed the existence of a previously undescribed species, which is described here.

Begonia caparaoensis E. L. Jacques & L. Kollmann, sp. nov. TYPE: Brazil. Minas Gerais: Alto Caparaó, Parque Nac., Vale Encantado e Cachoeira Bonita, 1890 m, 26 Fev. 2004, *L. S. Leoni 5625 & A. Chautems* (holotype, GFJP; isotype, MO). Figure 1.

Haec species quoad laminam foliarem peltatam, antheras obovatas etiam placentas bilamellatas *Begoniae jureiensi* S. J. Gomes da Silva & Mamede similis, sed ab ea foliis serrulatis (nec dentatis), stipulus majoribus atque stylis complanatis biramosis facile distinguitur.

Herbs rupicolous, puberulent, with an indumentum of simple and glandular trichomes, 15–40 cm tall; subterranean stems consisting of a tubercle-like structure, with very numerous adventitious roots; stems erect, internodes (2–)4–5 cm. Petioles terete, 9–11 cm, light pink to purplish red; stipules white or reddish, ca. 7 × 9 mm, deciduous, ciliate at margin; lamina (5–)9–21 × (5–)8.5–20 cm, ovate, peltate, in

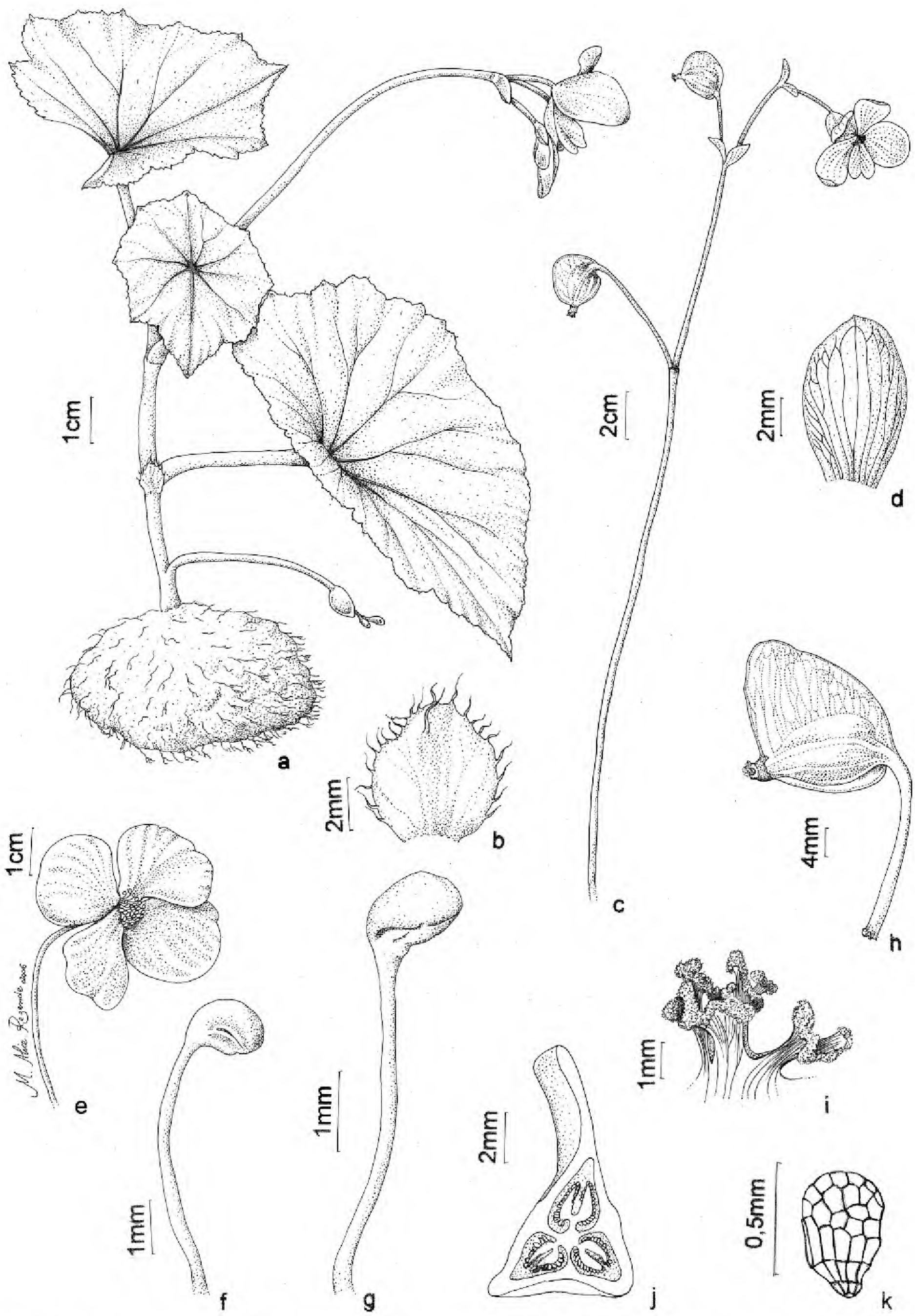

Figure 1. *Begonia caparaoensis* E. L. Jacques & L. Kollmann. —a. Habit. —b. Stipule. —c. Inflorescence. —d. Bract. —e. Staminate flower. —f. Stamens, side view. —g. Stamens, anther recurved. —h. Capsule. —i. Apex of the style branch. —j. Ovary in transverse section. —k. Seed. Drawn from the holotype *L. S. Leoni 5625 & A. Chautems* (GFJP).

vivo with a small central depression, shiny green, minutely pubescent on both surfaces, with an indumentum of simple and glandular trichomes, apex acute, margin lobate, serrulate, 8 primary veins, palmatinerved. Cymes (13–)17–30 cm, 3 to 5 flowers, 3- to 4-branched, peduncles reddish green; bracts persistent, 1–1.4 × 0.7–1.2 cm, ovate, margins with glandular trichomes, outer surface reddish green,

inner surface pink. Staminate flowers ca. 4 cm, pedicels 1.7–3.4 cm, purplish red, tepals white, tinged pale pink, the outer pair (1.5–)2–3 × (1.6–)2–3 cm, orbiculate, the inner pair 1.2–2.4 × 1.5–2.4 cm, obovate, stamens (49 to)80 to 100, 5–9 mm, yellow, filaments free, 4–6 mm, anthers obovate, 1–2 mm, recurved, extrorse, yellow, the connective scarcely projecting. Pistillate flowers 3.5–4 mm, pedicels 2.5–3 cm to 5.2 cm in mature fruits, tepals 5, unequal, 1.5–2.6 × 1.3–2.6 cm, white, tinged pale pink, oblong to obovate, apex obtuse to orbiculate, with glandular microscopic trichomes, prophylls 1(to 2) or absent, elliptic, margins fimbriate, 4–5 × 2–3 mm, white to lightly pink, styles 3, spirally twisted, 2-branched, stigma with a flabelliform base, yellow, with stigmatic papillae along margins. Ovary triloculate, reddish, 10–12 mm, placentation axillary, placentae bilamellate with the ovules on both sides of lamellae. Immature capsules trialate, 1–2.5 × 1.1–2.2 cm (including wings), glossy red, with glandular trichomes, peduncles (2–)2.5–5 cm, wings unequal, the largest wing (5–)10–15 mm tall, the smallest wing 1–2 mm tall; seeds ca. 0.5 × 0.25 mm, oblong, cylindrical.

Distribution, habitat, and phenology. *Begonia caparaoensis* is endemic to Parque Nacional do Caparaó, Minas Gerais, Brazil (20°24′29″S, 41°50′29″W), where a number of endemic species have recently been described, including *Vanhouttea leonii* Chautems (Gesneriaceae). *Begonia caparaoensis* grows in rocky outcrops, in rock crevices, near waterfalls and rivers in sunlit places, at altitudes between 1600 and 1890 m. During humid months, *B. caparaoensis* receives continuous mist from the adjacent waterfall, while during the dry months this moisture stops and the plants lose their stem and leaves so that only the tuberous part remains. This same phenomenon of losing external parts has also been observed, for example, in *B. alchemilloides* Meisner ex A. DC. and *B. quetamensis* L. B. Smith & B. G. Schubert (Jacques, 2002). The new species was observed associated with *Sinningia* Nees, *Peperomia* Ruiz & Pavón, pteridophytes, and bryophytes.

IUCN Red List category. Due to the endemic distribution of *Begonia caparaoensis* in the Atlantic Forest from Minas Gerais State and the area of occupancy estimated to be less than 10 km², it seems appropriate to identify this species as Critically Endangered (CR B2a) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The specific epithet alludes to the type locality (Parque Nacional do Caparaó), a well-preserved area of the Atlantic Forest in the state of Minas Gerais, Brazil.

Discussion. Among eight Brazilian species of *Begonia* with peltate blades and bilamellate placentae (*Begonia egregia* N. E. Brown, *B. espiritosantensis* E. L. Jacques & Mamede, *B. ibitiocensis* E. L. Jacques & Mamede, *B. jureiensis* S. J. Gomes da Silva & Mamede, *B. lealii* Brade, *B. lubbersii* E. Morren, *B. paulensis* A. DC., and *B. santoslimae* Brade; Jacques, 2002), *B. caparaoensis* is morphologically similar to *B. jureiensis*, which is endemic to Serra da Juréia, a well-preserved area of the Atlantic Forest in the southern coast of São Paulo State, Brazil. However, *B. jureiensis* is characterized by leaves with dentate margins, larger stipules (ca. 3 × 1.5 cm), and a flattened, branched style that is almost kidney-shaped.

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A New Species of *Cyanus* (*Centaurea* p.p.) sect. *Napuliferi* (Asteraceae) from Turkey

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Abstract. A new species of *Cyanus* Miller (*Centaurea* L. p.p.) (Asteraceae), *C. eflanensis* Kaya & Bancheva, is described and illustrated from Karabük Province, Turkey. It belongs to *Cyanus* sect. *Napuliferi* (Stefanoff & T. Georgiev) Bancheva & Raimondo, and taxonomically its closest relative is *C. thirkei* (Schultz Bipontinus) Holub. The habitat and conservation status of the new species are presented, and the morphological characters distinguishing *C. eflanensis* and *C. thirkei* are analyzed and illustrated.

Key words: Asteraceae, Cardueae, *Centaurea*, *Cyanus*, IUCN Red List, Karabük, Turkey.

Centaurea L. s.l. is one of the largest genera in Asteraceae. Depending on the classification used, the genus comprises between 200 and 700 species (Bremer, 1994; Hellwig, 2004; Bancheva & Greilhuber, 2006). Turkey is one of the main centers of diversity for this group (Wagenitz, 1986). Because *Centaurea* s.l. is considered a taxonomically unnatural grouping, recent approaches have split this taxon into several, more natural genera: *Centaurea* s. str., *Cyanus* Miller, *Psephellus* Cassini, and *Rhaponticoides* Vaillant (Greuter, 2003; Hellwig, 2004).

According to Hellwig (2004), the genus *Cyanus* comprises ca. 25 species. In the *Flora of Turkey*, 15 species of *Cyanus* (as *Centaurea* sect. *Cyanus*) were included by Wagenitz (1975). In this paper, we describe a new species, which increases the total number of *Cyanus* known from Turkey to 16 species. There are nine endemic species of *Cyanus* in Turkey; therefore, approximately 56% of this group known from Turkey are endemic taxa.

In Turkey, these *Cyanus* species are found on rocky and grassy slopes, stony calcareous slopes (scree), montane and shrub steppe, alpine and subalpine meadows and pastures, open pine and oak forests and shrub, dry meadows, fields, and roadsides, and range between 500 and 3500 m in altitude.

The taxonomic complexity of *Centaurea* s.l., especially in the Near East, has stimulated much recent research (Wagenitz, 1983; Kaya, 1986, 1987; Hellwig, 1994; Wagenitz & Hellwig, 1997; Kaya & Vural, 2007).

The new species was collected in 2006 and again in 2007, near the town of Eflani, in Karabük Province in the western Black Sea region of Turkey. These field investigations were part of a joint research project between the Scientific and Technological Research Council of Turkey (TUBITAK) and the Bulgarian Academy of Sciences. Herbarium specimens of the new species and allied taxa are deposited in ISTE and SOM.

Cyanus eflanensis Kaya & Bancheva, sp. nov. TYPE: Turkey. Karabük (A4): 10 km W of Eflani town, on dry grassy places in open pine forest, 1020–1031 m, 41°20′25.7″N, 32°42′1.9″E, 6 June 2007, *Z. Kaya & S. Bancheva 84027* (holotype, ISTE; isotype, SOM). Figure 1.

Haec species *Cyano thirkei* (Schultz Bipontinus) Holub affinis, sed ab eo radice palari simplici (sine radicibus lateralibus) cylindrico-incrassata (1–1.5 cm vs. 0.5–1 cm diam.) usque ad 10 cm (vs. 4 cm) longa, ciliis appendicum phyllariorum 0.9–1.1 mm (nec 2–3 mm) longis margini scarioso 0.2–0.3 mm (nec 1–2 mm) lato insidentibus atque flosculis violaceo-purpureis (nec albidis) differt.

Perennial plants, lacking stolons, with single thickened taproot to 10 cm, ca. 1–1.5 cm diam., abruptly narrowed above into a short, ± horizontal neck; stem single, ascending, 10.5–23 cm tall. Leaves loosely villous, ± glabrescent; lower leaves pinnatifid to pinnatipartite with 2 to 4 pairs of lanceolate segments or entire, usually not forming basal rosette at flowering; median and upper leaves entire to pinnatipartite, sessile. Capitulum single, 1.5–2 cm wide; involucre 11–15 × 8–11 mm; phyllaries elongate-triangular, glabrate; appendages with decurrent, light to dark brown, 0.2–0.3 mm wide scarious margin, with cilia 0.9–1.1 mm. Florets violet-purple; marginal florets radiating, divided into 4 to 6 narrowly

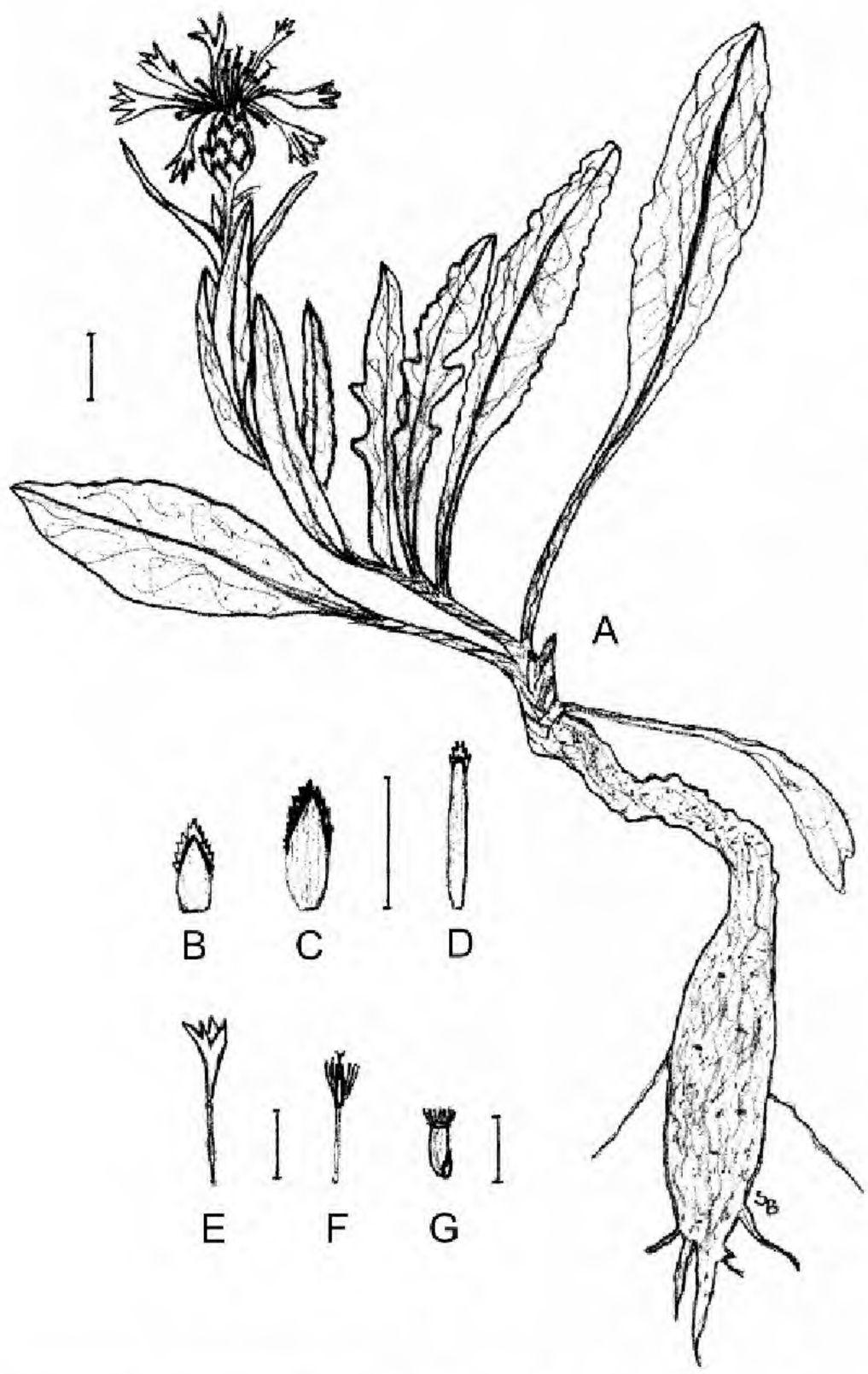

Figure 1. *Cyanus eflanensis* Kaya & Bancheva. —A. Habit. —B. Outer phyllary. —C. Median phyllary. —D. Inner phyllary. —E. Sterile radiant floret. —F. Hermaphrodite tubular floret. —G. Achene. Scale bars: A–F = 1 cm, G = 5 mm. Drawn by S. Bancheva from the holotype *Z. Kaya & S. Bancheva 84027* (ISTE).

triangular lobes. Achenes 4–4.5 × ca. 2 mm, with a basal-lateral elaiosome; pappus 1.1–1.2 mm.

Habitat and distribution. The new species is currently known only from one locality in the western Black Sea region of Turkey. *Cyanus eflanensis* grows in dry grassy areas under the fairly open canopy of a *Pinus nigra* J. F. Arnold forest, on more or less deep soil, between 1020 and 1031 m in elevation. Other associates include *Juniperus oxycedrus* L., *Quercus pubescens* Willdenow, *Ligustrum vulgare* L., *Pyracantha coccinea* M. Roemer, *Pyrus elaeagnifolia* Pallas, *Briza media* L., *Cephalanthera rubra* (L.) Richard, *Dactylis glomerata* L., *Inula ensifolia* L., *Iris kerneriana* Ascherson & Sintenis ex Baker, *Jurinea consanguinea* DC., *Lotus corniculatus* L., *Muscari tenuiflorum* Tausch, and *Scabiosa ochroleuca* L.

IUCN Red List category. The new species is endemic to the western Black Sea region of Turkey. The specimens were collected in Karabük Province (A4), where the species is apparently very rare and local. *Cyanus eflanensis* is known only from one population in the type locality occupying an area of 1000 m². The population was not in good condition at the time of our fieldwork, numbering approximately 150 to 200 plants. According to IUCN Red List criteria (IUCN, 2001), it should be assigned to the Critically Endangered (CR) category because of its local distribution and small population size.

Phenology. The new species was collected in flower June–July and in fruit in July.

Etymology. The species epithet recognizes the town of Eflani, the type locality of the new species.

Relationships. *Cyanus eflanensis* belongs to section *Napuliferi* (Stefanoff & T. Georgiev) Bancheva & Raimondo. The group is well characterized by its thickened, spindle-shaped or turnip-shaped roots, and relatively small leaves, often with a deeply cut blade and white woolly indumentum (Bancheva & Raimondo, 2003). Based on morphology, the closest ally of *C. eflanensis* is *C. thirkei* (Schultz Bipontinus) Holub, which has a broader distribution, occurring in

Table 1. Morphological comparison of selected characters used to distinguish *Cyanus eflanensis* and *C. thirkei*.

	C. eflanensis	*C. thirkei*
Root type and size	single thickened taproot, to 10 × 1–1.5 cm	taproot with (1 to)2 to 4(to 5) thickened, napiform or fusiform lateral roots, to 2–4 × 0.5–1 cm
Stem height (cm)	10.5–23	5–10(–15)
Involucrum size (mm)	11–15 × 8–11	16–20 × 10–15
Phyllary appendages: length of marginal cilia (mm)	0.9–1.1	2–3
Phyllary appendages: width of scarious margin without cilia (mm)	0.2–0.3	1–2
Achene length (mm)	4–4.5	3–4(–4.5)
Pappus length (mm)	1.1–2.2	1–1.2
Color of florets	violet-purple	whitish
Habitat	*Pinus nigra* forest	dry grassy and rocky places
Flowering	June–July	March–June

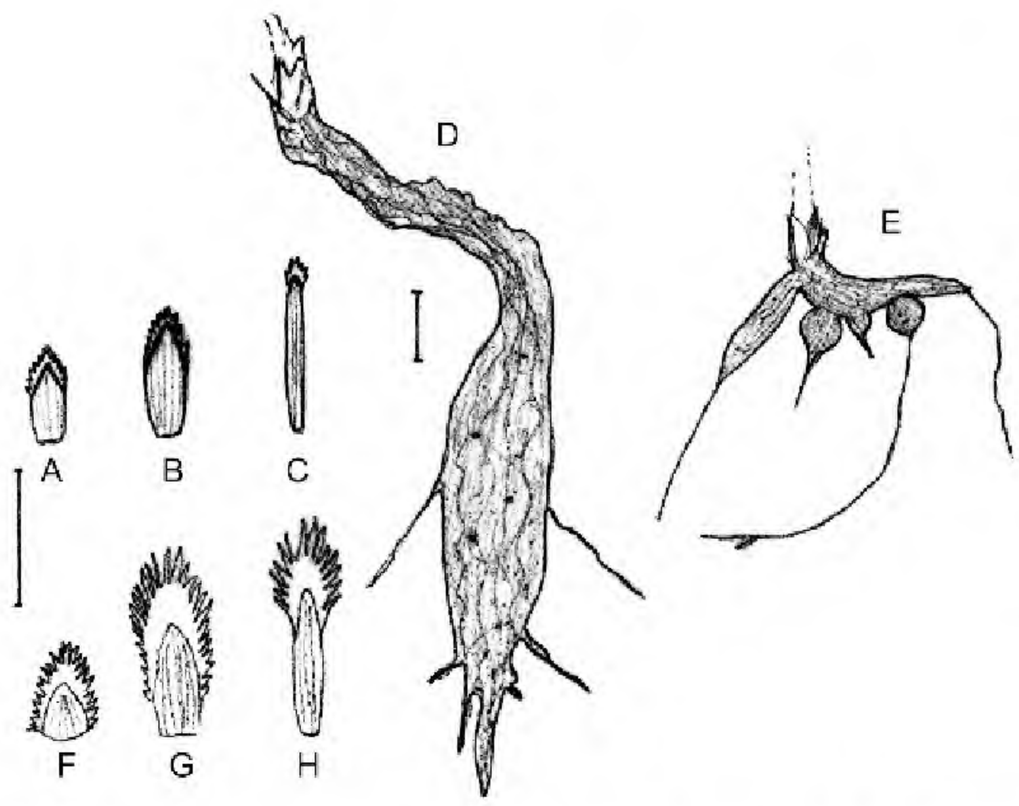

Figure 2. Comparison of phyllaries and roots. A–D. *Cyanus eflanensis* Kaya & Bancheva. —A. Outer phyllary. —B. Median phyllary. —C. Inner phyllary. —D. Root. E–H. *C. thirkei* (Schultz Bipontinus) Holub. —E. Root. —F. Outer phyllary. —G. Median phyllary. —H. Inner phyllary. Scale bars: 1 cm. Drawn by S. Bancheva; A–D from the holotype *Z. Kaya & S. Bancheva 84027* (ISTE), E–H from *Z. Kaya & S. Bancheva 84914* (SOM).

Bulgaria, Moldavia, and Turkey. The distribution of *C. thirkei* in Turkey is confined to the Mediterranean-climate area of western Turkey (A1, B1, B2, B3, C2 and C3) (Wagenitz, 1975), so the two mentioned taxa are allopatric.

The authors studied pertinent specimens and published descriptions (Wagenitz, 1975; Dostal, 1976; Bancheva & Raimondo, 2003) and determined that *Cyanus eflanensis* and *C. thirkei* differ morphologically (Fig. 2, Table 1). The diagnostic characters are contrasted in the following key couplet.

Key to Two *Cyanus* Species in Turkey

1a. Plant with (1 to)2 to 4(to 5) thickened adventitious roots, to 4 × 1 cm; florets usually whitish . . *C. thirkei*
1b. Plant with a single thickened taproot, to 10 × 1–1.5 cm; florets violet-purple . . . . . *C. eflanensis*

Paratypes. TURKEY. **Karabük (A4):** 10 km W of Eflani town, on dry grassy places in open pine forest, 1020–1031 m, 41°20′25.7″N, 32°42′1.9″E, 8 July 2007, *Z. Kaya & S. Bancheva 86016* (ISTE, SOM).

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Solanum anomalostemon (Solanaceae), an Endangered New Species from Southern Peru with Unusual Anther Morphology

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Abstract. *Solanum anomalostemon* S. Knapp & M. Nee is described from Cusco in southern Peru. The species is endemic to the Río Apurímac basin and is known from very few collections. The new species has unique anther morphology within *Solanum* L.; this is compared to other anther variants in the genus. Potential relationships of this unusual and enigmatic species are discussed, the new species is illustrated, and a preliminary conservation assessment of Endangered (EN) is proposed.

Resumen. *Solanum anomalostemon* S. Knapp & M. Nee se describe de Cusco para el sur de Perú. La especie es endémica de la cuenca del Río Apurímac y conocida por muy pocas colecciones. La especie nueva tiene anteras con una morfología única en *Solanum* L., que son comparadas con otras variaciones de anteras en el género. Las relaciones potenciales de *S. anomalostemon* están detalladas; se ilustra la especie y se le atribuye un estado de conservación preliminar de En Peligro (EN).

Key words: Anther morphology, IUCN Red List, Peru, Solanaceae, *Solanum*.

Solanum L., with ca. 1500 species, is the largest genus in the Solanaceae and one of the 10 most species-rich genera of flowering plants (Frodin, 2004). The highest species diversity in the genus occurs in South America and is concentrated in the Andes (Knapp, 2002a). As part of the collaborative project "PBI *Solanum*: A world-wide treatment" (see Knapp et al., 2004; <http://www.nhm.ac.uk/solanaceaesource>), descriptions of all species of *Solanum* are being provided online. This intensity of work in the genus by a large number of collaborators, along with the massive increase in specimens available from the Andean regions of South America and intensive work in the undetermined collections of herbaria worldwide, has meant that many new taxa are being discovered (Knapp, 2005, 2007; Granados-Tochoy & Orozco, 2006; Nee et al., 2006; Granados-Tochoy et al., 2007). In addition, the intensive global monographic project, in conjunction with a commitment by the botanical community to achieving Targets 1 (a global plant species checklist) and 2 (preliminary conservation assessments for all known plant species) of the *Global Strategy for Plant Conservation* (GSPC; Secretariat of the CBD, 2002), means that recognition and description of endemic taxa or those facing a significant conservation threat is particularly timely.

Our recent work in many herbaria has uncovered an unusual endemic species from southern Peru. Until recently, this species has only been known from sheets collected in the late 1930s, so we feared it might be extinct. However, recent material received at NY from the intensive collecting program being undertaken jointly in southern Peru by personnel of CUZ and MO proved to be this unusual species. Peru forms one of the most species-rich and endemic-rich areas in South America (Knapp, 2002a); the country previously had 102 endemic species (Knapp et al., 2006), and this new species boosts that number to 103.

Solanum anomalostemon S. Knapp & M. Nee, sp. nov. TYPE: Peru. Cusco: Prov. Anta, Dist. Limatambo, Cunyac, 13°33′S, 72°32′W, 2710 m, 3 May 2003 (fl., fr.), *W. Galiano, P. Núñez, G. Calatayud & I. Huamantupa 5109* (holotype, CUZ; isotypes, MO, NY). Figure 1.

Species nova *Solano chamaesarachidio* Bitter similis, sed ab eo habitu suffruticis nani, foliis profunde ternatis vel pinnatifidis, antheris ad basim cordatis et ad apicem prolongatis, stylis et filamentis glabris atque seminibus etuberculatis differt.

Dwarf subshrubs or herbs 30–50 cm, perennial from a woody taproot, branching from near the base; stems robust, ± erect, densely glandular-pubescent

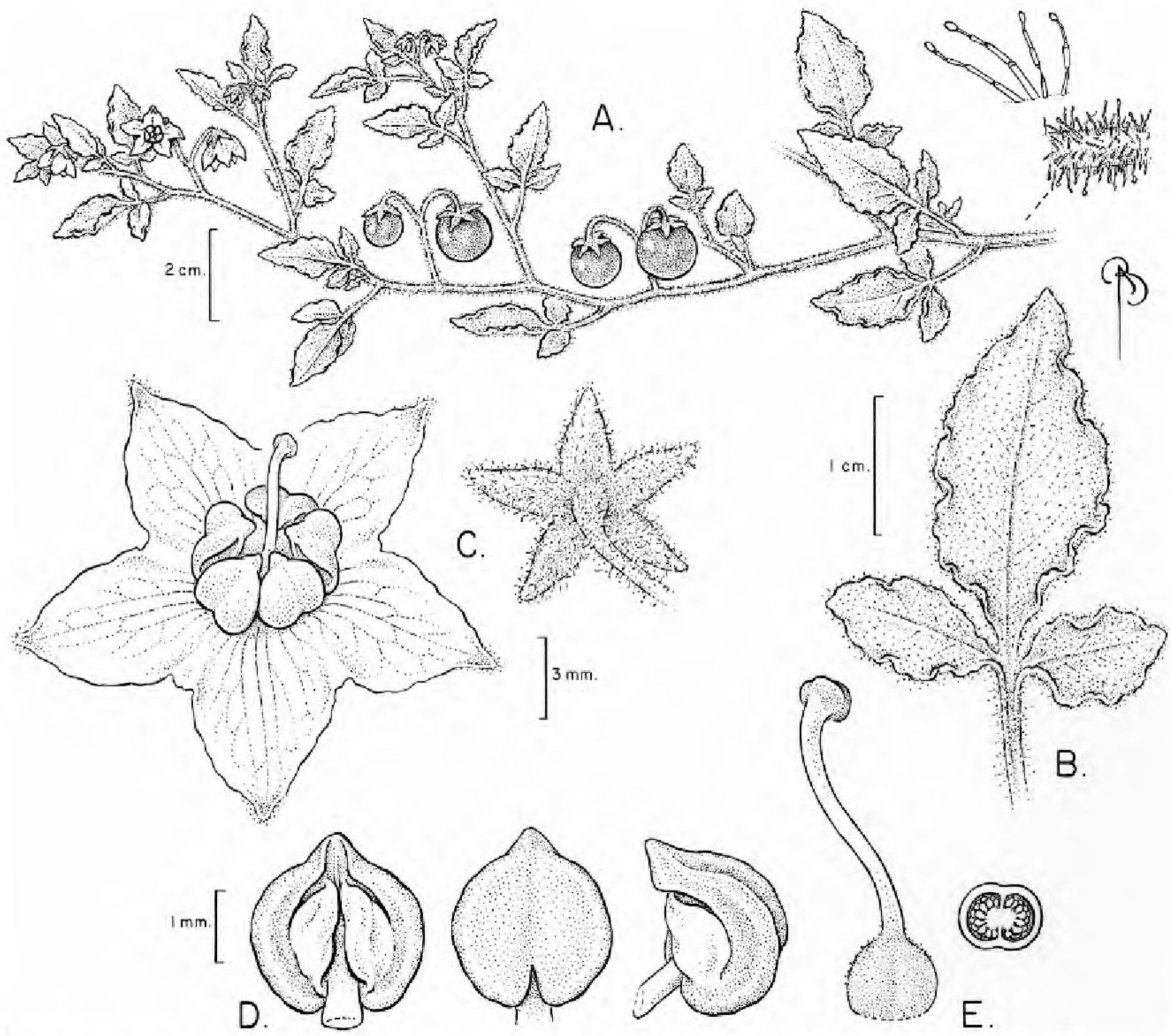

Figure 1. *Solanum anomalostemon* S. Knapp & M. Nee. —A. Habit. —B. Leaf. —C. Flower, with abaxial calyx surface shown at right. —D. Anther (abaxial, adaxial, and side views). —E. Gynoecium, curved style, and capitate stigma, with ovary cross section shown at right. Drawn from *Galiano et al. 5109* (NY).

with a mixture of glandular and eglandular simple, uniseriate trichomes, 0.3–1 mm; sympodial units not geminate, usually difoliate, but sometimes 3- to 4-foliate. Leaves ternate to pinnatifid, (1–)1.5–3.5 × (1–)1.5–2.5 cm, ± triangular to ovate in outline, thick and succulent, pubescent both adaxially and abaxially with a mixture of glandular and eglandular simple uniseriate 1- to 5-celled trichomes, 0.5–1 mm, the basal cell usually larger and broader, the gland 1-celled; leaflets 3(to 5), usually not discrete but with a wing of connecting leaf tissue; lateral leaflets 1–2 × 0.5–0.8 cm, if leaflets 5 then the basal one much smaller, 0.2–0.5 × ca. 0.2 cm, the base decurrent on the rachis and usually oblique and basiscopically extended, the margins entire to irregularly erose, the apex truncate; terminal leaflet 1.2–2 × 0.7–1.1 cm, always larger than the lateral leaflets, the base attenuate onto the rachis, the margins irregularly erose, the apex truncate; rachis sulcate, densely glandular-pubescent with simple uniseriate trichomes like those of the stems; petiole 1–2 cm, densely pubescent. Inflorescence 1–2 cm, internodal, 2-flowered, densely pubescent with a mixture of glandular and eglandular, uniseriate, simple trichomes, 0.3–0.6 mm; peduncle 1–2 cm, the flowers at the tip of the inflorescence; pedicels 0.5–0.7 cm, stout, ca. 1 mm diam., densely pubescent like the inflorescence, articulated at the base. Buds globose to slightly depressed-globose, the corolla enclosed in the foliose calyx lobes; flowers all perfect, white; calyx with the tube < 0.5 mm, an open cup, the lobes 2–3 × 1–1.5 mm, elliptic to somewhat spatulate, densely pubescent on both surfaces with eglandular simple uniseriate trichomes, ca. 0.3 mm; corolla 1.5–1.7 cm diam., stellate, lobed 1/3–1/2 way to the base, the lobes 0.3–0.5 cm, 0.3–0.4 cm wide at base, deltate, somewhat campanulate at anthesis, with 3 main veins in the center of each lobe, these drying darker, pubescent abaxially with simple uniseriate trichomes, these denser on the lobe midveins, papillate at the tip; stamens 5, equal, the filament tube ca. 0.5 mm, the free portion of the filaments 1–1.1 mm, glabrous, the anthers 2.5–3 × 2–2.1 mm, cordate, abaxially thickened and densely papillate, the basal lobes ca. 0.5 mm, the apex prolonged with a small beak ca. 1 mm long, dehiscing by longitudinal slits from apical pores intially; ovary conical, densely papillate; style 4.5–5 × ca. 1 mm, glabrous, strongly curved at anthesis; stigma ca. 1 mm diam., capitate, densely papillate. Fruit a globose berry, 1–1.4 cm diam., the pericarp shiny and brittle when dry, black (*Galiano et al. 5109*),

orangish brown when dry; fruiting pedicels 1.2–1.5 × 0.1–0.15 cm, curving and deflexed; seeds 10 to 20 per berry, 3–3.1 × 1.9–2.1 mm, somewhat ovoid, reniform in outline, the margins slightly thickened, the testa with sinuate cells, not tuberculate, appearing shallowly pitted and covered with what appears to be remains of fruit pulp.

Distribution. The new species occurs in southern Peru on rocky and clayey arid slopes at ca. 2800 m (ca. 13°30′S, 72°40′W) on either side of the Río Apurímac west of Cusco on the road to Abancay.

IUCN Red List category. *Solanum anomalostemon* is known from only four collections, all collected within 20 km of each other in the Río Apurímac drainage. The species had not been collected for more than half a century until its recent rediscovery in Cusco Department, on the other side of the Apurímac. The dry forests in which it occurs are not widely protected in Peru, and *S. anomalostemon* does not occur in or near any of the Peruvian network of protected areas (see <http://www.inrena.gob.pe>). *Solanum anomalostemon* can be added to the list of endemic Peruvian solanums, and using the IUCN Red List criteria (IUCN, 2001) we suggest it be given a preliminary conservation status of Endangered (EN B1a[iii], B2a) based on its restricted distribution (extent of occurrence < 5000 km^2, area of occupancy < 100 km^2), low number of populations (2), and threatened and unprotected habitat. A more thorough assessment is of interest, not only to discover if it still occurs in Apurímac Department on the other side of the Río Apurimac, but also to assess its population size where it does occur.

Phenology. All specimens have both flowers and fruits, so the species appears to flower and fruit throughout the year. It may do so in response to rainfall, as do many species of tomatoes (Peralta et al., 2008).

Etymology. The species epithet is taken from the Greek "anomalogos" (meaning "not agreeing" or "inconsistent"; e.g., anomalous) and "stemon" (meaning "stamen"), in reference to the unique stamens, which are anomalous in the genus *Solanum*.

Discussion. *Solanum anomalostemon* appears to be unique in *Solanum* in its cordate, sharply pointed anthers with a prolonged beak-like apex, which dehisce by longitudinal slits that are only poricidal very briefly at the beginning of anthesis. Otherwise, *Solanum* is remarkably uniform in basic anther morphology in the ca. 1500 species. Approximately 95% of the species are divided between two groups: (1) those with oblong anthers with relatively large terminal pores and later longitudinal dehiscence to a greater or lesser extent (the nonspiny solanums), and (2) species with attenuate anthers with very small terminal anthers that do not later enlarge (the Leptostemonum and Wendlandii clades [sensu Bohs, 2005; Weese & Bohs, 2007]). In other nonspiny solanums (excluding the Wendlandii clade [sensu Bohs, 2005; Weese & Bohs, 2007]), the anthers split longitudinally with age, but the pores are distinct at the beginning of anthesis (Knapp, 2002b). Throughout *Solanum* many different types of anther modifications occur in almost all of the monophyletic clades in the genus (Levin et al., 2006; Anderson et al., 2006). Heterandry can be present, either by the unequal growth of a single filament (e.g., *S. uncinellum* Lindley of the Dulcamaroid clade [sensu Bohs, 2005; Weese & Bohs, 2007], or *S. turneroides* Chodat of the Brevantherum clade [sensu Bohs, 2005; Weese & Bohs, 2007]), or by variously unequal anthers (e.g., *S. rostratum* Dunal and all but one of the other species of section *Androceras* (Nuttall) Marzell of the Leptostemonum clade). Members of the Pachyphylla clade (sensu Bohs, 2005; Weese & Bohs, 2007, formerly *Cyphomandra* Martius ex Sendtner) have unusually thickened connectives, and in the tomatoes the anthers are tightly connate and have a sterile tip that functions as a single pore (Glover et al., 2004; Peralta et al., 2008). The Argentine species *S. delitescens* C. V. Morton, of the Geminata clade, has ellipsoid anthers that are narrowed and apparently sterile in the lower third.

The anthers of *Solanum anomalostemon* are most like those of the small section *Chamaesarachidium* Bitter (*S. chamaesarachidium*, *S. gilioides* Rusby, and *S. annuum* C. V. Morton; considered part of the Morelloid clade on morphological grounds pending molecular investigation [G. Barboza, pers. comm.]). These tiny, often annual, plants of the high Andes have basally appendaged anthers, somewhat reminiscent of the cordate anther base of *S. anomalostemonum*. In habit and leaf morphology *S. anomalostemon* also resembles the species of section *Chamaesarachidium*: the plants are shrublets or small perennial herbs and the leaves are variously pinnatifid (Barboza, 2005). *Solanum chamaesarachidium* has glandular pubescence like that of *S. anomalostemon*, but has a marked basal connectival extension and is a much smaller, apparently annual plant (Barboza, 2005). The flowers of members of section *Chamaesarachidium* are usually somewhat campanulate at anthesis, as apparently are the flowers of *S. anomalostemon*. The seeds of *S. anomalostemon* are not tuberculate, as are those of all known species of section *Chamaesarachidium*. There are herbaceous species in the Andes of section *Parasolanum* A. Child (*S. tripartitum* Dunal and relatives) with somewhat similar leaves, but these lack the glandular hairs, and anthers are more typical of the nonspiny solanums. Although the relationships of

S. anomalostemon remain obscure at present, we suggest it belongs to the Morelloid clade based on its overall morphology; sequence data, however, suggest it is anomalous in the genus and of uncertain affinities (L. Bohs, pers. comm.).

Paratypes. PERU. **Apurímac:** hillside above Curahuasi, Cuzco region, 9000 ft., 15 Jan. 1938 (fl., fr.), *H. L. Blood & L. Tremelling 209* (NY); Trancapata, Curahuasi, Abancai, Jan. 1938 (fl., fr.), *C. Vargas 756* (F, GH); Trancapata, Curahuasi, 2800 m, 18 Nov. 1938 (fl., fr.), *C. Vargas C. 2000* (K); Prov. Abancay, Disto, Trancapata, Curahuasi, slopes of Garbanzopata, environs of Ccoto-mayo, 2800 m, 9 Nov. 1938 (fl., fr.), *C. Vargas 9611* (F, GH, K).

Acknowledgments. We thank Gloria Calatayud (CUZ) for searching the herbarium in Cuzco to find the holotype sheet; Bobbi Angell for the illustration; the curators of the herbaria cited in the text for permission to examine their material; and Gloria Barboza (CORD) for valuable advice on Andean solanums. Financial support for this work came from the National Science Foundation Planetary Biodiversity Inventory (award DEB-0316614 "PBI *Solanum*—A worldwide treatment").

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Draba calcifuga (Brassicaceae), a New Species from the Rocky Mountains of North America

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Abstract. *Draba calcifuga* Lesica (Brassicaceae) is an alpine species of the Rocky Mountains of Montana, Idaho, and Wyoming, U.S.A., restricted to noncalcareous soils. It has been confused with the sympatric *D. oligosperma* Hooker because both species are similar in habit, leaf size and shape, fruit size and shape, style length, and in the presence of doubly pectinate trichomes on the leaves. However, *D. calcifuga* has cilia and pectinate trichomes with crisped branches that do not occur in *D. oligosperma*. *Draba calcifuga* demonstrates low pollen stainability throughout its range, suggesting it is agamospermous. Although *D. oligosperma* is agamospermous over most of its range, it is sexual in its area of sympatry with *D. calcifuga*, suggesting that the latter may be derived from the former. *Draba calcifuga* is described and compared to four other species with doubly pectinate trichomes from the Rocky Mountain region.

Key words: Agamospermy, Brassicaceae, *Draba*, Idaho, IUCN Red List, Montana, Wyoming.

Draba L. is the largest genus in the Brassicaceae with ca. 350 species occurring primarily in temperate to arctic regions (Rollins, 1993). New species continue to be described, even in relatively well-known floras (Mulligan, 1970; Dorn, 1978; Price, 1980; Al-Shehbaz & Windham, 2007). Delineation of species can be difficult due to frequent polyploidy and agamospermy. Perennial species frequently have remarkably similar growth forms and are often distinguished by trichome shape (Hitchcock, 1941; Mulligan, 1976). Four described species of *Draba* in the Rocky Mountains have doubly pectinate trichomes: *D. oligosperma* Hooker, *D. pectinipila* Rollins, *D. juniperina* Dorn, and *D. incerta* Payson (Mulligan, 1976; Dorn, 1978; Rollins, 1993). Here I describe a fifth species, *D. calcifuga* Lesica, with doubly pectinate trichomes. *Draba calcifuga* has commonly been mistaken for *D. oligosperma* because it is similar in size and has doubly pectinate trichomes on leaf surfaces. I compare it to *D. oligosperma* and other similar species occurring in the Rocky Mountains and use evidence from pollen stainability studies to propose a possible scenario for the origin of this species. Although *D. calcifuga* is likely primarily asexual, it displays morphological, ecological, and geographical integrity, prompting me to describe it as a new species.

Methods

I examined 17 morphological characters considered important for separating perennial species of *Draba* in western North America (Hitchcock, 1941; Mulligan, 1976) from 28 herbarium sheets of *D. calcifuga* from southwest Montana and adjacent Wyoming. Measurements were taken from leaves, scapes, flowers, and mature fruits of representative plants on each sheet.

I used pollen stainability as a metric of agamospermy for *Draba oligosperma* and *D. calcifuga* (Radford et al., 1974; Price, 1980). I collected one anther from each of five flowers on three to five flowering specimens on herbarium sheets representing 17 populations of *D. oligosperma* and 12 populations of *D. calcifuga*. Anthers were macerated in a drop of analine blue dye in lactophenol on a microscope slide (Radford et al., 1974). For each slide I scored 100 pollen grains from randomly chosen 100× microscope fields as either full or empty (see Mulligan & Findlay, 1970: figs. 3, 4).

Species of *Draba*

Draba calcifuga Lesica, sp. nov. TYPE: U.S.A. Montana: Ravalli Co., Bitterroot Range, common in gravelly soil derived from metamorphic parent material in a fellfield on the summit of St. Mary's Peak with *Ivesia gordonii*, *Phlox diffusa*, and *Eritrichium nanum*, 2850 m, T9N R21W S28, 15 July 2007, *P. Lesica 9819 with P. Kittelson* (holotype, MONTU; isotypes, MO, MONT, NY, RM). Figure 1.

Haec species inter congeneros scaposos Montium Saxosorum trichomatibus bis pectinatis vestitos quoad scapum glabrum etiam pedicellos breves ad *Drabam oligospermam* maxime accedit, sed ab ea foliis ad marginem ciliatis et ad paginam abaxialem trichomatibus pectinatis pro parte stipitatis pubescentibus distinguitur.

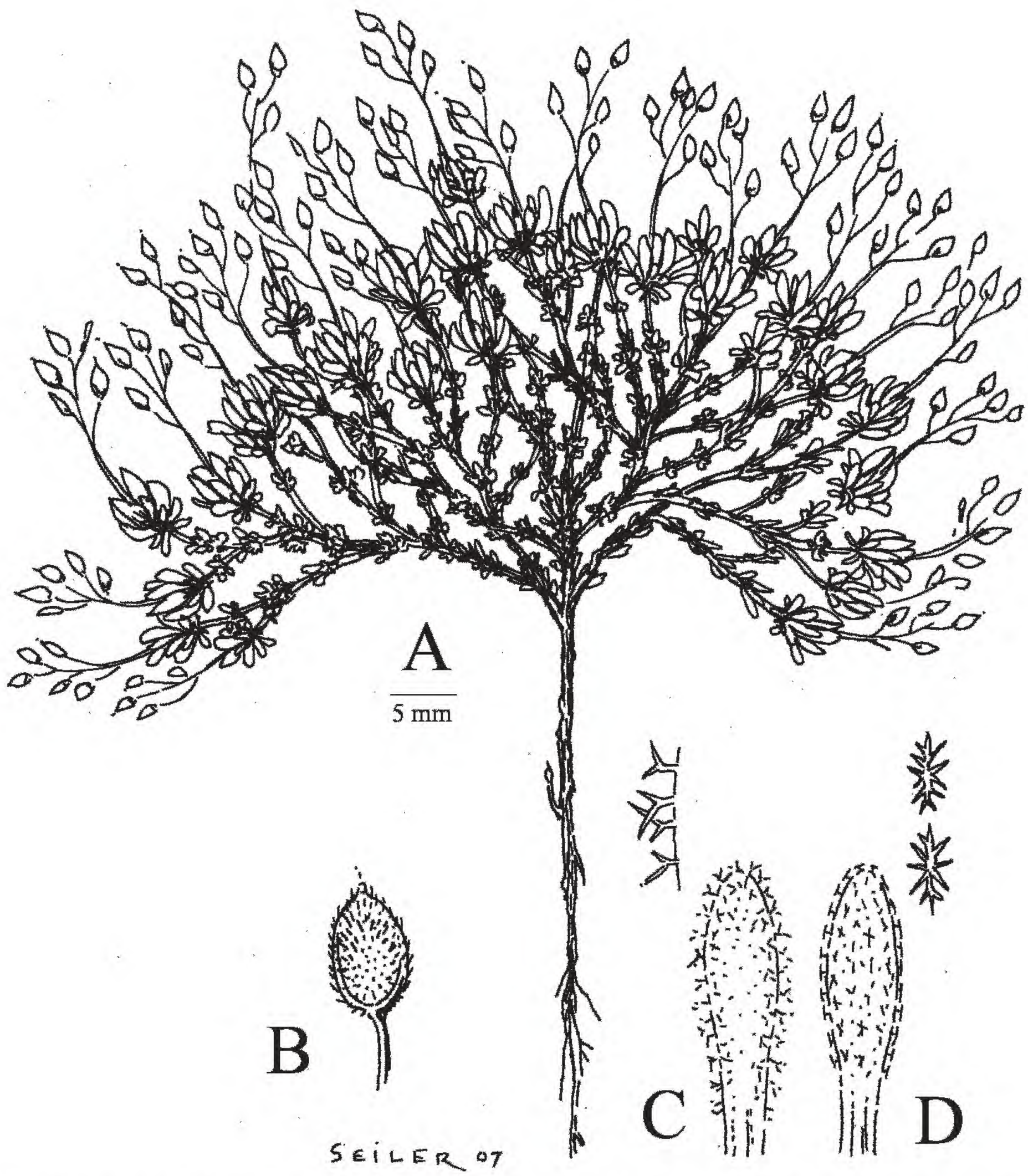

Figure 1. *Draba calcifuga* Lesica. —A. Whole plant. —B. Fruit. —C. Leaf and marginal trichomes of *D. calcifuga*. —D. Leaf and marginal trichomes of *D. oligosperma* for comparison. Drawn from the holotype, *Lesica 9819* (MONTU).

Caespitose, scapose, perennial herbs from a taproot surmounted by a caudex, forming cushions 1–3 cm tall; caudex branches covered with old leaf bases and terminating in rosettes. Leaves oblanceolate, entire, 1.5–5.5 × 0.5–1.1 mm, tapering to a petiole-like base; abaxial surface with sessile or stalked, pectinately branched trichomes sometimes mixed with stalked, stellate trichomes; adaxial surface glabrous or with sparse simple or branched trichomes; margins ciliate with twisted simple or few-branched trichomes; scapes erect, 4–25 mm, typically glabrous or rarely with stalked-stellate trichomes. Racemes 2- to 8-flowered, ebracteate; fruiting pedicels ascending, the lowest 1.2–5 mm; sepals ovate, 1.6–3 × 0.7–1.4 mm, glabrous or with sparse twisted, simple or forked trichomes; petals yellow, obovate, 2.3–4 × 1.2–2.1 mm, the claw 0.5–1 mm; filaments ca. 1.5 mm; anthers ca. 0.6 mm; silicles ovate, 2.5–5.3 × 1.9–3.5 mm with short, usually recurved, simple or forked trichomes 0.1–0.2 mm; fruiting style 0.2–0.6 mm; seeds 2 to 5 per silicle, 0.8–1.7 mm.

Distribution and habitat. *Draba calcifuga* occurs at or above treeline in non-calcareous mountain ranges in Beaverhead, Deer Lodge, Gallatin, Granite, Madison, Park, Powell, Ravalli, and Silver Bow counties in southwest Montana, Blaine and Lemhi counties in Idaho, and Park and Sublette counties in Wyoming. *Draba calcifuga* appears to be a strict calcifuge, occurring only on substrates derived from

Table 1. Morphological and habitat characters differing among four species of *Draba* with pectinate trichomes (Hitchcock, 1941; Dorn, 1978; Lichvar, 1983).

	D. calcifuga	*D. incerta*	*D. juniperina*	*D. oligosperma*	*D. pectinipila*
Scape trichomes	none	branched	pectinate	none	pectinate
Scape height (cm)	0.4–2.5	1–12(–20)	(5–)7–15	1–4(–9)	(4–)5–9(–11)
Pedicel length (cm)	0.1–0.5	0.6–1.8	0.5–1	0.1–0.5	0.5–1.2
Style length (mm)	0.2–0.6	0.4–1	0.7–1.5	0.1–1	0.3–0.7
Leaf cilia	simple, branched	branched	none	none	none
Leaf trichomes	sessile, stalked-pectinate	stalked-pectinate	sessile, pectinate	sessile, pectinate	sessile, pectinate
Silicle trichomes	simple, branched	simple, branched	pectinate	simple	pectinate
Silicle length (mm)	2.5–5.3	6–10	4–7	2.5–7	5–8
Chromosome number (n)	unknown	56	11	32	unknown
Habitat	alpine	alpine	montane	montane to alpine	alpine

granitic, metamorphic, and volcanic parent materials, although calcareous parent materials are common at both low and high elevations in southwest Montana and adjacent Idaho. It is most common in the granitic-batholith Bitterroot, Pioneer, Anaconda, and Tobacco Root mountain ranges in Montana. *Draba oligosperma* is also common in this part of Montana, but only at lower elevations and primarily in calcareous soils, although it has a wider ecological amplitude elsewhere (Hitchcock, 1941; Mulligan, 1972; Lesica, 2002).

IUCN Red List category. *Draba calcifuga* is estimated to be Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001). The species occurs above timberline in habitats that are generally not impacted by human disturbance. Several known occurrences are from areas protected as designated wilderness where mechanized impacts are not allowed. Collections voucher at least 25 populations, extent of occurrence is at least 50,000 km^2, and there is no reason to believe that there has been any reduction in population size.

Phenology. Plants flower June through July, depending on aspect and elevation. Mature fruit is present July through September.

Etymology. The specific epithet refers to the fact that the plant has never been collected on soils derived from calcareous parent material although such soils are common within the range of the species.

Discussion. *Draba calcifuga* shows little morphological variation throughout most of its range. However, one population from the Gravelly Range in Madison County, Montana (*Lesica & Cooper 4929*, MONTU), has nearly glabrous silicles. Several specimens from the Absaroka–Beartooth region along the Montana–Wyoming border (*Beyer 6*, *Lackschewitz 9782*, MONTU; *Jennison 313*, MONT; *Lichvar 1895*, RM) have stalked-stellate trichomes on the scape, but otherwise conform to the description of *D. calcifuga*. These collections may represent local variants on the edge of the species' range or may indicate that *D. calcifuga* has had more than one independent origin. Such polytopy has been demonstrated for several arctic-alpine, agamospermous, perennial species of *Draba* (Brochmann et al., 1992). Understanding the relationships of *D. calcifuga* to other species will require further cytological and molecular genetics studies.

Affinities. Vestiture of leaves, scapes, and silicles are important in delimiting *Draba calcifuga* from the other scapose species with doubly pectinate trichomes in the Rocky Mountains (Dorn, 1978; Lichvar, 1983). *Draba pectinipila* and *D. juniperina* have sessile pectinate trichomes on the scape and silicles but lack cilia or stalked-stellate trichomes on the leaves as in *D. calcifuga*. *Draba oligosperma* has glabrous scapes and similar silicle vestiture as *D. calcifuga* but lacks cilia and stalked trichomes on the leaves. *Draba incerta* has stalked-pectinate trichomes and ciliate margins but has larger fruits than any of these other species (Table 1). These species have usually been considered closely related because of the trichome similarities (Hitchcock, 1941; Lichvar, 1983; Rollins, 1993). However, *D. oligosperma* and *D. juniperina* have different chromosome base numbers ($x = 8$ vs. $x = 11$, respectively; Windham, 2000). A recent molecular phylogeny based on ITS sequences suggests that *D. oligosperma* and *D. juniperina* may not be members of the same clade (Belstein & Windham, 2003) and that doubly pectinate trichomes may have arisen independently at least twice.

Draba calcifuga is presumed to be agamospermous because all populations had less than 30% pollen stainability, and nine of 12 measured populations had less than 2% stainability. Pollen stainability of *D. oligosperma* populations was bimodal; 12 populations

had less than 12%, and 5 populations had more than 65% stainability. Populations of *D. oligosperma* with more than 65% stainable pollen are presumably sexual, and all occur in southwest Montana (Mulligan & Findlay, 1970), in approximate sympatry with *D. calcifuga*. Agamospermy is common in many genera of temperate vascular plants, such as *Crataegus* L., *Hieracium* L., and *Taraxacum* L., resulting in a large number of relatively homogeneous species (agamospecies sensu Richards, 1986; microspecies sensu Grant, 1971). Agamospermy has been demonstrated for several species of north-temperate *Draba* that differ from close congeners in silicle shape and vestiture (Mulligan & Findlay, 1970; Mulligan, 1976; Price, 1980). A large proportion of agamospecies have been formed following hybridization between sexual species (Stebbins, 1950; Grant, 1971; Richards, 1986; Bayer, 1987). It may not be a coincidence that the range of *D. calcifuga* broadly overlaps that of sexual *D. oligosperma*, which is agamospermous throughout most of its range. Reed Rollins (pers. comm.) suggested that *D. calcifuga* might be a hybrid between *D. oligosperma* and the sympatric *D. densifolia* Nuttall, probably because the latter is strongly ciliate, although the cilia of *D. densifolia* are simple and straight rather than branched and wavy.

Comparative types examined. [All specimens from GH, K, and US were viewed as high-resolution images.] U.S.A. *Draba incerta* Payson, *A. Nelson & E. Nelson 5818* (GH, US); *Draba laevicapsula* Payson, *Leiberg 1477* (GH, US); *Draba oligosperma* var. *andina* Nuttall, *Nuttall s.n.* (US); *Draba oligosperma* var. *leiocarpa* O. E. Schulz, *Blankenship 50* (MONT); *Draba oligosperma* var. *microcarpa* Blankenship, *Blankenship 9617* (MONT); *Draba saximontana* A. Nelson, *Nelson 4323* (GH, US). CANADA. *Draba oligosperma* Hooker, *Richardson s.n.* (K).

Paratypes. U.S.A. **Idaho:** Lemhi Co., Beaverhead Mtns., Elk Mtn., *R. Moseley 334* (ID); Lemhi Range, W of Meadow Lake, *S. Brunsfield & P. Brunsfield 103a* (ID); Blaine Co., Pioneer Mtns., Laidlaw Creek, *R. Moseley 2785* (ID). **Montana:** Beaverhead Co., Pioneer Range, Tweedy Mtn., *P. Lesica 1615* (MONTU); Comet Mtn., *K. Lackschewitz 9572* (MONTU); Keokirk Mtn., *P. Lesica 5537* (MONTU); Deerlodge Co., Anaconda Range, E Pintlar Peak, *K. Lackschewitz 6859* (MONTU); Gallatin Co., Madison Range, Table Mtn., *P. Lesica 2247* (MONTU); Spanish Peaks, 1901, *Vogel s.n.* (MONT); Granite Co., Anaconda Range, plateau W of Storm Lake, *K. Lackschewitz 3779* (MONTU); Park Co., Beartooth Range, W Boulder Plateau, *K. Lackschewitz 9766* (MONTU); Powell Co., Flint Creek Range, *P. Lesica 9478* (MONTU); Ravalli Co., Bitterroot Range, Boulder Peak, *K. Lackschewitz 617* (MONTU); Sweeney Peak, *K. Lackschewitz 1281* (MONTU); St. Mary's Peak, *Arno 1087* (MONTU); Silver Bow Co., Highland Mtns., Table Mtn., *D. Woodland 1132* (MONTU). **Wyoming:** Park Co., Beartooth Range, Gardner Lake Overlook, *P. Lesica 1506* (MONTU); Yellowstone Natl. Park, Dunraven Pass, *P. Hawkins 619* (MONT); Sublette Co., Wind River Range, Union Peak, *Fertig 4283* (RM).

Key to the Rocky Mountain Species of *Draba* with Pectinate Trichomes

1a. Leaf margins with simple or forked cilia. 2
1b. Leaves not ciliate 3
2a. Silicles 2.5–5.3 mm; scapes usually glabrous, < 3 cm . . . . . *D. calcifuga*
2b. Silicles > 6 mm; scapes often > 3 cm with branched trichomes . . . . . *D. incerta*
3a. Scape glabrous; silicles with mainly simple trichomes . . . . . *D. oligosperma*
3b. Scape with pectinate trichomes; silicles with mainly branched trichomes 4
4a. Style 0.3–0.7 mm; petals white, mostly 3–4 mm. . . . . *D. pectinipila*
4b. Style 0.7–1.5 mm; petals yellow, mostly 4–5 mm . . . . . *D. juniperina*

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A New Species of *Hetaeria* (Orchidaceae) from Hainan, China

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Abstract. *Hetaeria shiuyingiana* L. Li & F. W. Xing, a new species of Orchidaceae (Orchidoideae, Cranichideae, Goodyerinae) from Hainan, China, is described and illustrated. It has previously been misidentified as the related *H. nitida* Ridley, but differs in its larger flowers, broader, obovate petals, lip hypochile with finger-like tripartite papillae, and column with two fleshy sigmoid wings. A key is provided to distinguish the seven species of *Hetaeria* Blume known from China.

Key words: China, Hainan, *Hetaeria*, IUCN Red List, Orchidaceae.

Hetaeria Blume is a genus of terrestrial orchids (Orchidoideae, Cranichideae, Goodyerinae) (Pridgeon et al., 2003). It comprises about 30 species, distributed in tropical Africa, the Himalayan region, through Southeast Asia to New Guinea, Australia, New Caledonia, and Fiji (Su, 2000; Pridgeon et al., 2003). The generally accepted characters of the genus are the inflorescences with several to many flowers that have the lip in a non-resupinate position, one to many papillae or glands on each side of the sac-shaped hypochile, and the bifid rostellum that rises vertically with the lateral stigmas at the base (Seidenfaden, 1978). In China, there are six species, with four reported from Hainan Province (Lang, 1999; Yeh et al., 2005; Song et al., 2007).

During a botanical expedition to Baoting County in Hainan Province in 2005, an unusual *Hetaeria* was collected by Xin-Sheng Qin. Morphological study shows that it closely corresponds to a plant that has been previously identified as *H. nitida* Ridley by Hu (1977: 49). In China, the name was based on a single specimen, *Hu 13233* (K), collected in Hong Kong, but the identification was later disputed by Seidenfaden and Wood (1992), as *H. nitida* has smaller flowers and spatulate petals. In fact, more than a decade earlier Seidenfaden had suggested that plants from Khao Sabab in Thailand that had been identified as *H. nitida*, which have considerably broader petals than the type specimen of *H. nitida* (*Curtis s.n.*, SING), as well as the other specimens cited in their treatment (Seidenfaden & Smitinand, 1965), ought to be considered a separate species (Seidenfaden, 1978). Because the 2005 collection provided insufficient material for identification, we temporarily regarded this new collection as an imperfectly known species.

In 2006, more material of this species was collected by the authors in Ledong, Baoting, and Wuzhishan counties from Hainan Province, and we now have quite a few living plants in the greenhouse of the South China Botanical Garden, Chinese Academy of Sciences, where they have flowered every year in March since 2005. Detailed literature study (Hooker, 1890, 1894; Ridley, 1896; Holttum, 1957; Seidenfaden & Smitinand, 1959, 1965; Backer & Bakhuizen van den Brink, 1968; Seidenfaden, 1978, 1992; Bose & Bhattacharjee, 1980; Yeh et al., 2005; Song et al., 2007) and comparison with orchid specimens in K, KUN, IBSC, and PE revealed that this species is indeed similar to *H. nitida*, but is remarkably different in its column wings. In fact, the characters associated with these structures are quite distinctive in the genus and are critical in determining its taxonomy (Fig. 1). This species is further distinguished from *H. nitida* in its larger flowers, broader, obovate petals, and lip hypochile with finger-like tripartite papillae. A detailed study of our fresh collections clearly establishes that the Hainan plants represent a new species. A key to the *Hetaeria* species from China, based on these essential details of the flowers, is provided below. It is noteworthy that, based on the present material, there is no true *H. nitida* in China. Some specimens previously considered to be *H. nitida* (Barretto & Young, 1980; Siu & Chau, 1999) could very well be identical with this new species.

Hetaeria shiuyingiana L. Li & F. W. Xing, sp. nov. TYPE: China. Hainan: Ledong County, eastern Jianfeng Mtn., Weidong Forestry Center, fl. in cult. at South China Botanical Garden, 8 Apr. 2007, *Li Lin 014* (holotype, IBSC). Figure 1.

Species *Hetaeriae nitidae* Ridley affinis, sed ab ea floribus manifeste majoribus, petalis latioribus oblique obovatis, hypochilo labelli saccato basi utrinque papillis tripartitis 2-seriatis et plerumque papilla solitaria simplici gracili ornato

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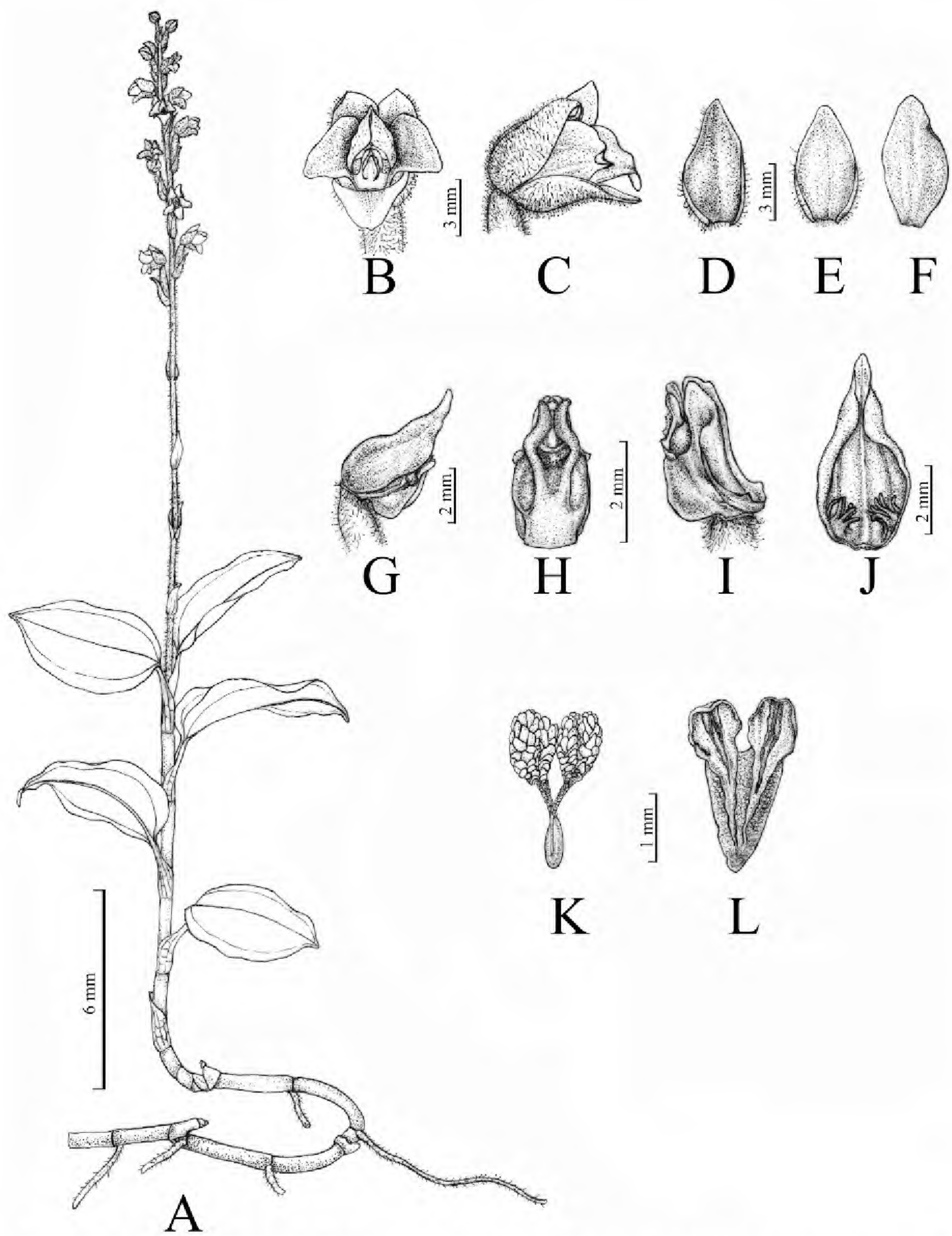

Figure 1. *Hetaeria shiuyingiana* L. Li & F. W. Xing. —A. Habit. —B. Front view of flower. —C. Lateral view of flower. —D. Lateral sepal. —E. Dorsal sepal. —F. Petal. —G. Lateral view of flower with sepals and petals removed. —H. Front view of column. —I. Lateral view of column. —J. Lip. —K. Pollinia. —L. Operculum. Drawn from the holotype *Li Lin 014* (IBSC).

atque columnae alis 2 plerumque minute papillosis aliquanto sigmoideis sursum extensis rostelli lobis aequilongis vel eis longioribus differt.

Erect terrestrial herb, up to 20 cm tall; rhizome terete, creeping, several-noded, fleshy, 5–20 cm, 2–3 mm thick; internodes 2–3 cm; roots arising from rhizome nodes, elongate, pubescent; stem erect, ascending from rhizome, glabrous, succulent, dark purple, 8–15 cm, 4–5 mm diam., 2- to 5-leaved. Leaves ovate, 5–8 × 2–4 cm, apex shortly acuminate, base obliquely obtuse or round, deep green and lustrous adaxially, pale abaxially, distinctly 3-veined; petioles 2.5–3 cm, sheathed at base. Inflorescence slender; peduncle 20–22 cm, pubescent; sterile bracts 4, lanceolate, 1–2 cm, pinkish brown; rachis 7–9 cm, loosely spaced typically with 14 to 18 flowers; floral bracts lanceolate, 7–9 mm, puberulent outside, shorter than ovary. Flowers not resupinate, not opening widely; ovary densely glandular-pubescent, cylindrical, 8–10 mm; sepals subequal, obliquely ovate, obtuse at apex, densely glandular-pubescent, 6–7 × 3–4 mm, olive-green, pink along the margin and at apex; dorsal sepal slightly recurved at apex; lateral sepals embracing the base of the lip, slightly smaller;

petals connivent with dorsal sepal and forming an inverted hood, glabrous, lateral, obliquely ovate, apex obtuse, 6 mm long, 3–3.5 mm wide across the middle, glistening pinkish white, slightly curved outward; lip adnate to margins of the column, honey yellow in color, fleshy, lageniform, 5.6 mm long, 2.2 mm thick at base, with a short mesochile and 3-partite; hypochile concave, saccate, ca. 2.5–3 mm, containing 2 groups of tripartite papillae at base on each side, arranged along the lateral veins, usually with 1 separate basal slender papilla near the groups; mesochile with involute margins, folding inward with an orange-colored patch; column short and stout, ca. 1 mm high at the back, 2 mm wide across the middle, extending upward into 2 fleshy ± sigmoid wings, usually with a minutely papillose surface, pointing upward on each side ventrally, with upcurved lower edges laterally; epichile entire, attenuate, margins involute, 1–1.2 mm, white; anther ovoid, 2-locular; pollinia 4 in 2 pairs, sectile, clavate, basally attenuate into slender caudicles, attached to an oblong viscidium; rostellum erect, bifid, with 2 broad arms, linear-oblong, ca. 1 mm, gradually narrowing toward apex; stigmas 2, lateral. Capsule erect, fusiform.

Distribution and habitat. This terrestrial orchid grows in wet and shady areas at elevations of 600 to 800 m, in Hainan and Hong Kong, on the windward side of evergreen broad-leaved forests, in the low understory.

IUCN Red List category. *Hetaeria shiuyingiana* is known only from small populations in Ledong, Baoting, and Wuzhishan counties from Hainan Province, and only a single specimen (collected in 1971) has been collected from Hong Kong. We estimate its population to total fewer than 250 mature individuals. In addition, Ridley (1896) reported that the leaves of *H. obliqua* Blume are used as medicine in peninsular Malaysia, and it is possible that *H. shiuyingiana* might also be collected for use as medicine. For these reasons, *H. shiuyingiana* can be considered at high risk of extinction in the wild, and should be classified as Endangered (EN) according to criterion D (restricted population size) of the IUCN Red List criteria (IUCN, 2001).

Phenology. *Hetaeria shiuyingiana* flowers in March and April.

Etymology. The species epithet honors the well-known Chinese botanist, Hu Shiu Ying (1908–), of the Chinese University of Hong Kong, who has shared her rich knowledge of this orchid with us.

Relationships. *Hetaeria shiuyingiana* is similar to *H. nitida* from Penang, Malaysia, but differs in its conspicuously larger flowers (sepals 6–7 × 3–4 mm), its petals that are broader (3–3.5 mm wide) and obliquely ovate, the lip hypochile with a pair of tripartite papillae and usually a single basal slender and finger-shaped papilla at the base on each side, and the two thick, more or less sigmoid wing-like appendages on the ventral side of the column, usually with a minutely papillose surface and pointing upward as long as or slightly longer than the rostellum arms. *Hetaeria nitida*, on the other hand, has much smaller flowers (sepals ca. 4 × 2 mm), spatulate petals (0.8–1.6 mm wide) that are not noticeably oblique, the lip hypochile with a pair of close papillae with irregular terete fleshy branching, and rostellum arms that extend above the column wings, which are rather large, broad, oblong flaps that are curved and folded.

Paratypes. CHINA. **Hainan:** Baoting County, Ganzhaling, 800 m, 20 July 2006, *Li Lin 017* (IBSC); Wuzhi Mtn., in cult. at South China Botanical Garden, 16 Apr. 2007, *Li Lin 108* (PE).

KEY TO THE SPECIES OF *HETAERIA* FROM CHINA

1a. Lip with conspicuously enlarged epichile, bilobulate, with large orbicular lobules . . . . . *H. anomala* Lindley
1b. Lip with an acuminate or slightly enlarged epichile, entire or 3-lobed.
  2a. Epichile slightly enlarged.
    3a. Epichile 3-lobed; sac of the hypochile with 2 hornlike papillae; disc with one group of irregular minute warts or with 2 short keels . . . . . *H. cristata* Blume
    3b. Epichile entire, most often heart-shaped; sac of the hypochile with 2 oblong, 2- to 4-lobed papillae in each half; disc without warts or keels. . . . . *H. affinis* Lindley
  2b. Epichile acuminate.
    4a. Sac of the hypochile with about 5 rather slender papillae in each half, most often spread along the 4 lateral veins.
      5a. Petals linear to lanceolate, ca. 1 mm broad, usually less; the strongly sigmoid wings on front of column usually with vertical triangular acute tips at their upper part . . . . . *H. oblongifolia* Blume
      5b. Petals rhombic to obovate, > 2 mm broad; the broad obtuse upper part of the column wings usually bent inward and overlapping. . . . . *H. finlaysoniana* Seidenfaden
    4b. Sac of the hypochile with ca. 1 pair of usually lobed or split thick papillae in each half, most often close beside each other.
      6a. Petals spatulate, not very oblique; sac of the hypochile with 2 or 3 papillae close beside each other in each half, shaped like flat scales with an irregularly lobed or dentate apex . . . . . *H. obliqua* Blume

6b. Petals obliquely ovate; sac of the hypochile with 2 close series of tripartite papillae and 1 single slender finger-shaped papilla near the series in each half . . . . . *H. shiuyingiana* L. Li & F. W. Xing

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A New Species of *Pseudostellaria* (Caryophyllaceae) from Gansu, China

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Abstract. A new species, *Pseudostellaria polymorpha* Y. S. Lian (Caryophyllaceae), is described from Gansu Province, China. The species is remarkable for the regular variation in its floral morphology from stem apex to base. The terminal chasmogamous flower is largest, having five oval-lanceolate sepals, five oblanceolate petals noticeably longer than the sepals, 10 stamens, and an ovary with two long filamentous styles. The flowers along the upper portions of the stems have four sepals, only two or three petals equal or slightly shorter than the sepals, six to eight stamens including one or two sterile ones, and an ovary with two filamentous, shorter styles. The cleistogamous flowers are solitary in the axils of the basal portion of the stem, with four densely pilose sepals, three petals obviously shorter than the sepals or reduced, two sterile stamens, and an ovary with two styles obviously shorter than the ovary itself. This floral transition is rare in *Pseudostellaria* Pax, and is therefore a feature by which the new species is easily distinguishable from other members of the genus.

Key words: Caryophyllaceae, China, Gansu Province, *Pseudostellaria*.

Pseudostellaria Pax is a small genus in the Caryophyllaceae with about 18 species known from Central Asia and Afghanistan to Japan, as well as Europe and North America (Dequan & Rabeler, 2001), with nine species distributed in China. While studying specimens of *Pseudostellaria* from Gansu Province in China in 2002, the author found two remarkable specimens of this genus. These represent a new species distinguished by its regular, basipetalous variation in floral morphology. This rare feature is not otherwise known in *Pseudostellaria* or in Caryophyllaceae, and it easily distinguishes the new species from other members of the genus.

Pseudostellaria polymorpha Y. S. Lian, sp. nov. TYPE: China. Gansu: Tianzhu Xian, Shimen ravine, under forest on shady slope, 2800 m, 20 June 1989, *Wang Qingrui & Yan Minsheng 12092* (holotype, NWTC). Figure 1.

Species haec ab omnibus congeneris florum structura ab apice ad imum caulium variationem ordinate praebente (petalorum et staminum longitudine manifeste abbreviata atque numeris citio reductis, stylorum longitudine manifeste abbreviata, sepalorum numero e 5 ad 4 reducto) distinguitur; quoad foliorum formam etiam scaules prostratos *Pseudostellaria himalaicae* (Franchet) Pax similis, sed ab ea caulis foliis ovatis usque late ovatis utrinque glabris vel interdum sparsim puberulis atque seminibus minute tuberculatis bene differt.

Perennial herbs with fusiform tubers; stems erect, 10–20 cm, with biseriate hairs, with creeping branches at lower nodes. Leaves opposite, ovate or widely ovate, 10–20 × 7–12 mm, membranous, glabrous or sparsely pubescent, apex acute, usually with mucro ca. 1 mm, base nearly rounded or widely cuneate, margins basally ciliate; petioles 1–4 mm. Flowers terminal or solitary in branch axils; pedicels 1.2–2.2 cm, with biseriate hairs. The chasmogamous flower terminal and largest, with 5 sepals oval-lanceolate, 3.2–3.6 × 0.9–1 mm, with a few scattered pilose hairs only along abaxial midrib; petals 5, oblanceolate, 4.7–5.1 × 1.1–1.4 mm, bilobed at apex, exceeding the sepals; stamens 10, to 4.5 mm, anthers purple; ovary coniform, 1–1.2 mm diam., with 2 filamentous styles to 4 mm, 2–3× longer than the ovary. Flowers along the upper half of stems, with 4 sepals oval-lanceolate, 2.5–3 × 0.6–0.8 mm; petals 2 or 3, subequal to sepals; stamens 6 to 8, ca. 1.5 mm, including 1 or 2 sterile ones ca. 0.8 mm; ovary coniform, 0.8–1.2 mm diam., with 2 filamentous styles to 1.3 mm, 1.2–1.6× longer than the ovary. Cleistogamous flowers solitary in axils of the lower stems; with 4 sepals linear-lanceolate, 2.5–3 × 0.4–0.6 mm, densely pilose; petals 3, 1–1.5 × 0.3–0.5 mm, obviously shorter than the sepals or reduced; stamens 2, sterile, ca. 1 mm; ovary coniform, 2–2.5 mm diam., with 2 styles, to 1 mm, much shorter than the ovary. Fruit a coniform capsule, with numerous seeds; seeds subglobose, ca. 1 mm diam., minutely tuberculate.

Distribution and habitat. *Pseudostellaria polymorpha* is known only from the type collected from Shimen ravine in Tianzhu County of Gansu Province, China. It was observed at elevations of 2750–2800 m, on shady slopes in forests.

The type locality in Tianzhu is located at the transitional zone from the Qinghai–Tibet plateau to Nei Mongol–Xinjiang plateau. The ecological conditions in the region are variable and quite harsh for the plants. It was difficult to assess the distributional

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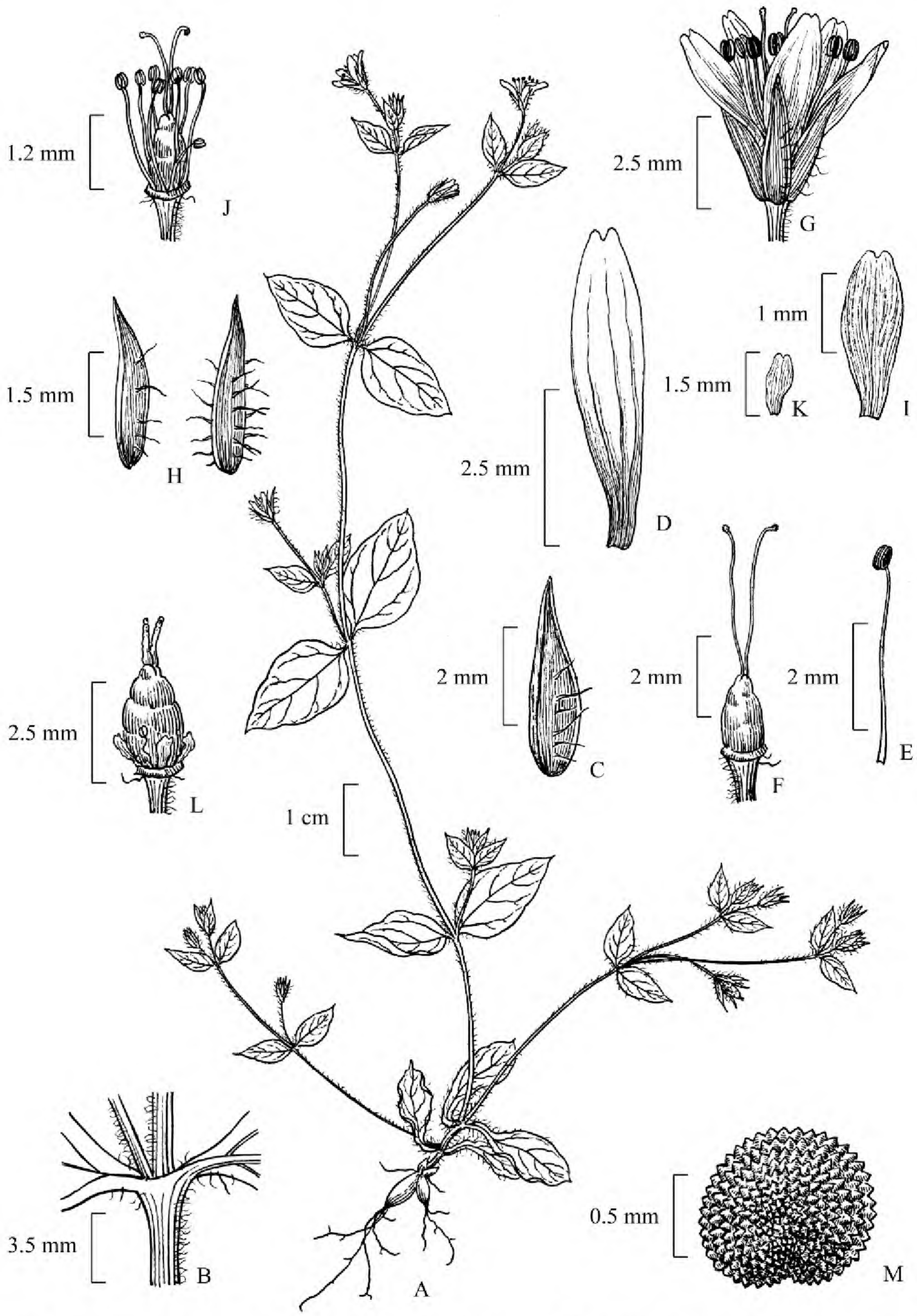

Figure 1. *Pseudostellaria polymorpha* Y. S. Lian. —A. Habit. —B. Stem with biseriate hairs. —C. Sepal of the chasmogamous flower. —D. Petal of the chasmogamous flower. —E. Stamen of the chasmogamous flower. —F. Gynoecium of the chasmogamous flower. —G. Chasmogamous flower. —H. Two sepals of flower from the upper half of erect stem. —I. Petal of flowers from the upper half of erect stem. —J. Stamens and gynoecium of flowers from the upper half of erect stem. —K. Reduced petal of lower cleistogamous flower. —L. Gynoecium of cleistogamous flower, with sterile stamen and reduced petals visible. —M. Tuberculate seed from cleistogamous flower. Drawn from the holotype (*Wang Qingrui & Yan Minsheng 12092*, NWTC) by Jianlu Bai.

extent of the new species, but it can be provisionally considered endemic to Tianzhu.

Phenology. *Pseudostellaria polymorpha* has been collected in flower in June and in fruit from June to July.

Discussion. The new species has an affinity with *Pseudostellaria himalaica*, with several characters in common, including the basic leaf shape and the prostrate stems. The two taxa differ in that the leaves of *P. polymorpha* are ovate to widely ovate and glabrous or sparsely pubescent, while those of *P. himalaica* are no more than ovate and are densely pubescent; the seeds of *P. polymorpha* are minutely tuberculate, while those of *Pseudostellaria himalaica* lack tubercles. Furthermore, *P. polymorpha* differs in its basipetalous variation in floral morphology. This feature is not previously known in *Pseudostellaria* and easily distinguishes the new taxon.

Capsules with seeds have been seen only from cleistogamous flowers on the basal stem. The cleistogamous flowers have larger ovaries and two styles that are shorter than the ovary, whereas flowers that are chasmogamous or located on the upper half of the stem have smaller ovaries and two styles that are longer than the ovary. Further study is needed to determine whether style length affects pollen tube development and fertilization.

Paratype. CHINA. **Gansu:** Tianzhu Xian, Shimen ravine, 2750 m, 21 June 1989, *Wang Qingrui & Yan Minsheng 12101* (NWTC).

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Clematis liuzhouensis (Ranunculaceae), a New Species from China

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ABSTRACT. A new species of *Clematis* L. (Ranunculaceae), *C. liuzhouensis* Y. G. Wei & C. R. Lin, is described and illustrated. The new species is related to *C. wissmanniana* Handel-Mazzetti, but differs in its leaflets that always have entire margins and are abaxially silvery-pannose and in its smaller sepals that are up to 1.5 × 0.6 cm.

Key words: China, *Clematis*, IUCN Red List, Ranunculaceae.

There are more than 300 species of *Clematis* L. (Ranunculaceae) in the world, and more than 100 species are found in China (Chang et al., 1980). During a field trip to Liuzhou shi, Guangxi Province, China, in 1989, we collected an unusual *Clematis* specimen with fruits only; however, we could not identify it without flowers. In 2006, we returned to Liuzhou shi to collect the flowers, and now establish it as a new species.

Clematis liuzhouensis Y. G. Wei & C. R. Lin, sp. nov. TYPE: China. Guangxi: Longtan Park, Liuzhou shi, 17 June 2006 (fl.), *Y. G. Wei 06220* (holotype, IBK; isotype, PE). Figure 1.

Species nova affinis *Clematidi wissmannianae* Handel-Mazzetti, a qua foliolis margine integris subtus argenteo-pannosis atque sepalis minoribus 1.1–1.5 cm longis et 0.4–0.6 cm latis differt.

Woody vines, 2–4 m long, branches angular, appressed puberulous. Leaves 2-pinnate or 2- to 3-ternate; leaflets papery, ovate-lanceolate, long-ovate, or ovate, 2.5–6 × 1.3–2.5 cm, apex acuminate, base rounded, margin always entire, adaxially appressed puberulous, abaxially densely silvery pannose. Cymes axillary, 4- to 7-flowered; peduncles 4–6.5 cm, puberulous; bracts lanceolate, ca. 6 × 2 mm. Flowers 2.8–3.2 cm diam., pedicels 1.5–3.5 cm, puberulous; sepals 4, spreading, white, oblong, 1.1–1.5 × 0.4–0.6 cm, densely puberulous externally, glabrous internally; stamens 50 to 87, glabrous, ca. 1.5 cm, filaments linear, anthers oblong, ca. 2 mm, apex obtuse. Achenes bilaterally compressed, ovate, ca. 5 × 2.5 mm, puberulous, persistent styles ca. 3 cm, plumose.

Distribution. *Clematis liuzhouensis* is known only from the type locality in Liuzhou shi, in Guangxi Province, China. It grows in association with *Bauhinia championii* (Bentham) Bentham, *Diospyros saxatilis* S. K. Lee, *Mallotus microcarpus* Pax & K. Hoffmann, and *M. philippinensis* (Lamarck) Müller Argoviensis.

IUCN Red List category. *Clematis liuzhouensis* should be considered Critically Endangered (CR A2c) according to IUCN Red List criteria (IUCN, 2001). Only 10 individuals were found on the limestone hills in an area of ca. 10 × 10 m^2, at an elevation of 150 m. Although no path exists to the site, the area is accessible to tourists, and tourism presents the principal threat of disturbance to the new species.

Phenology. The new species was collected in flower in June and in fruit in August.

Discussion. Based on floral structure, *Clematis liuzhouensis* belongs to section *Clematis* subsect. *Clematis*, characterized by its habit of woody vines or herbs; leaves that are 2-pinnate, 2-pinnate deep split, or 2- to 3-ternate; inflorescences in cymes or panicles; glabrous stamens; and lack of staminodes. The new species is characterized by its leaflets, which are covered abaxially with a beautiful and unusual silvery pannose indumentum, and this feature distinguishes *C. liuzhouensis* from its close ally, *C. wissmanniana* Handel-Mazzetti, as well as other species of that subsection. *Clematis wissmanniana* is found only in the adjacent Yunnan Province to the west of Guangxi, and is not sympatric with *C. liuzhouensis*.

Paratype. CHINA. **Guangxi:** Longtan Park, Liuzhou shi, 28 Aug. 1989 (fr.), *Longtan-Dule Expedition 00744* (IBK).

KEY TO *CLEMATIS LIUZHOUENSIS* AND *C. WISSMANNIANA* IN SOUTH CENTRAL CHINA

1a. Leaflets always with entire margins, abaxially silvery pannose; sepals to 1.5 × 0.6 cm. . . . . *C. liuzhouensis*

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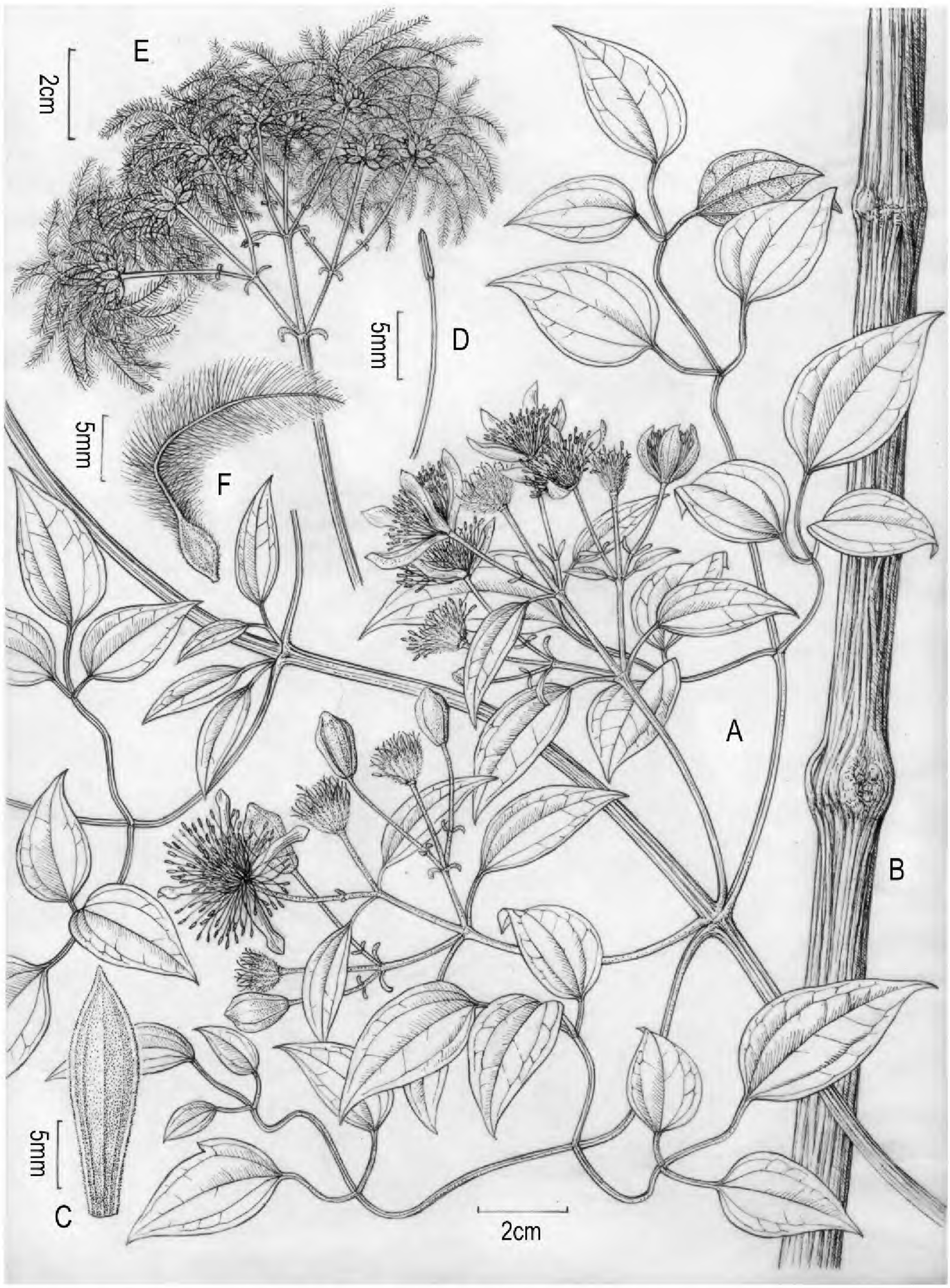

Figure 1. *Clematis liuzhouensis* Y. G. Wei & C. R. Lin. —A. Fertile habit showing the flowering cymes. —B. Older stem. —C. Sepal, abaxial surface. —D. Stamen. —E. Infructescence. —F. Achene. A–D drawn by S. Q. He from the holotype, *Y. G. Wei 06220* (IBK); E, F, from the paratype, *Longtan-Dule Exp. 00744* (IBK).

1b. Leaflets sometimes with entire margins or serrate, appressed pubescent on both surfaces; sepals to 2 × 1 cm . . . . . *C. wissmanniana*

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Hechtia caulescens (Bromeliaceae), a New Species from Central Mexico

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ABSTRACT. *Hechtia caulescens* López-Ferrari, Espejo & Martínez-Correa (Bromeliaceae), known from the states of Morelos, Puebla, and Oaxaca in Mexico, is described and illustrated. The new species is compared with *H. stenopetala* Klotzsch, from which it differs by its larger flowers and floral bracts, and by its twice-branched inflorescences.

RESUMEN. Se describe e ilustra *Hechtia caulescens* López-Ferrari, Espejo & Martínez-Correa (Bromeliaceae), conocida de los estados de Morelos, Puebla y Oaxaca, México. La nueva especie se compara con *H. stenopetala* Klotzsch, de la cual difiere por sus flores y brácteas florales más grandes y por sus inflorescencias más ramificadas.

Key words: Bromeliaceae, *Hechtia*, IUCN Red List, Mexico, Puebla.

Of the 18 genera of Bromeliaceae present in Mexico, *Hechtia* Klotzsch is particularly interesting due to its significant specific representation and its high level of endemism. With ca. 55 accepted species (Burt-Utley & Utley, 1987; Espejo et al., 2004, 2007a, 2008; Luther, 2006) and at least eight more species to be described (Espejo et al., 2007b), *Hechtia* is an almost entirely Mexican genus, with 50 species (90.9%) endemic to the country.

As part of our ongoing fieldwork for a monograph on Mexican Bromeliaceae, we collected plant material of an undescribed taxa of *Hechtia* and propose it here as new.

Hechtia caulescens López-Ferrari, Espejo & Martínez-Correa, sp. nov. TYPE: Mexico. Puebla: Mun. Izúcar de Matamoros, 2 km adelante de El Tepenene, carr. Izúcar–Acatlán, 18°28′42″N, 98°23′20″W, 1235 m, selva baja caducifolia, 20 jul. 2006 (♀), *N. Martínez C., A. Espejo, A. R. López-Ferrari & J. García-Cruz 58* (holotype, UAMIZ; isotypes, IEB, MEXU). Figure 1.

Haec species quoad flores albos parvos ac habitum caulescentem *Hechtiae stenopetalae* Klotzsch similis, sed ab ea floribus et bracteis floralibus majoribus atque inflorescentia bis ramosa distinguitur.

Herbs dioecious, terrestrial or saxicolous, caespitose, rosette-forming and long caulescent, forming large colonies, flowering 0.86–1.87 m high, the rosettes extended, actinomorphic, ca. 40 cm diam.; *stems* cylindrical, prostrate or decumbent at the apex, 22–30 × 3–3.7 cm diam. *Leaves* numerous, fleshy; sheaths amplexicaulous, light brown, lustrous, depressed-ovate, 3.2–4.7 × 4.9–6 cm, basally lustrous on both surfaces, apically white lepidote on both surfaces; blades erect to slightly curved at the apex, green to dark green, linear, 29–40 × 1.8–3 cm, densely white lepidote on both surfaces, long acuminate and apiculate, the margin loosely spiny with brown curved ascendant spines, 1.9–4 mm long, 1.5–1.9 cm apart. *Inflorescence* terminal, erect, paniculate, with numerous, densely packed flowers. *Staminate inflorescence* 0.86–1.6 m high, twice branched, scape cylindric, 30–56 cm × 4–12 mm diam., green, glabrous; *scape bracts* light brown, foliaceous, glabrous, entire; sheaths ovate to triangular, 1–1.4 × 1.1–1.2 cm; reduced blades linear, 4.2–7 cm × 3–4 mm, acuminate and apiculate, shorter than the internodes, reducing their length gradually to the apex; *primary branches* 1 per node, ascendant to erect, with the basal sterile portion flattened, 10–22 cm, each with 3 to 15 secondary branches; *primary bracts* light brown, ovate to triangular, 7–11 × 5–7 mm, slightly erose, acuminate; *secondary branches* 1 per node, ascendant, cylindric, 4.5–7 cm × 5–7 mm diam.; *floral bracts* light brown, triangular, acuminate, 2.2–2.5 × 1.3–1.7 mm, entire; *staminate flowers* ascendant to divaricate, sessile to subsessile; *sepals* light brown to brown basally, ovate-triangular, 2.1–2.2 × 1.6–1.8 mm, obtuse, entire; *petals* white, elliptic, 3.5–4 × 2–2.5 mm, rounded; *stamens* subequal, longer than the petals, filaments white, laminar, 2.8–3 mm, anthers white to whitish yellow, oblong, ca. 1 mm; *ovary* vestigial. *Pistillate inflorescence* to 87 cm high, twice branched, scape cylindric to 1 m × ca. 1.5 cm diam., green, glabrous; *scape bracts* light brown, foliaceous, glabrous, entire; sheaths ovate to triangular, 1–1.4 × 1.1–1.2 cm; reduced blades linear, 4.2–7 cm × 3–4 mm, acuminate and apiculate at the apex, shorter than the internodes, reducing their

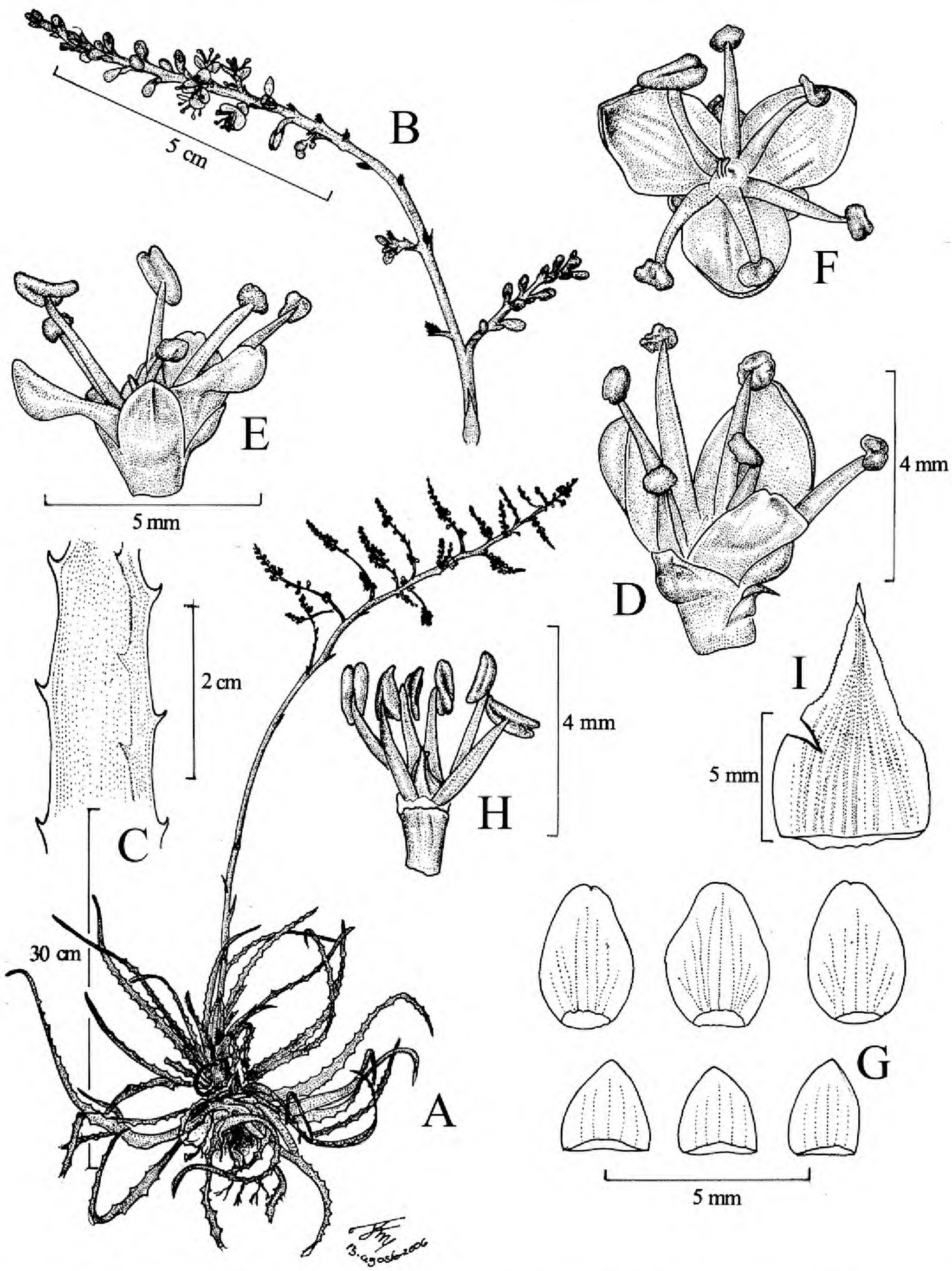

Figure 1. *Hechtia caulescens* López-Ferrari, Espejo & Martínez-Correa. —A. Habit. —B. Primary branch of inflorescence. —C. Margin of leaf. —D, E. Staminate flowers, side view. —F. Staminate flower, front view. —G. Dissected tepals, staminate flower. —H. Androecium. —I. Primary bract, staminate inflorescence. Drawn from *Martínez C. et al. 68* (UAMIZ).

length gradually to the apex; *primary branches* 1 per node, ascendant, with the basal sterile portion flattened, (2–)6–24 cm long, each with (2)6 to 18 secondary branches; *primary bracts* light brown, triangular to widely triangular, 12–15 × 4.5–6 mm, entire, glabrous, narrowly acuminate; *secondary branches* 1 per node, ascendant, cylindric, 2.5–9 cm × 5–7 mm diam.; *floral bracts* light brown, triangular,

Table 1. Morphological differences between *Hechtia caulescens* and the affined *H. stenopetala*. The *H. stenopetala* data were based on the revision of 34 specimens examined by the authors from CICY, ENCB, MEXU, MO, and XAL.

	H. caulescens	*H. stenopetala*
Inflorescence	twice branched, with 3 to 15 (♂) or 6 to 18 (♀) well-developed secondary branches	once branched or basally twice branched, with 2 barely developed secondary branches
Pistillate flowers	sepals triangular, 2.7–3.7 × 1.3–1.7 mm; petals 3.4–3.8 × 1.1–1.4 mm; ovary ovoid to long-ovoid, 3.3–3.9 × 1.2–1.5 mm	sepals triangular to ovate, 1.4–2.3 × 1–2 mm; petals 2.5–3 × 1.3–1.6 mm; ovary ellipsoid, 3–4 × ca. 2 mm
Staminate flowers	sepals ovate-triangular, 2.1–2.2 × 1.6–1.8 mm; petals elliptic, 3.5–4 × 2–2.5 mm, rounded; stamens 2.8–3 mm; anthers white to whitish yellow, ca. 1 mm	sepals elliptic to widely triangular, 1.8–2.1 × 1.2–1.7 mm; petals widely elliptic to widely oblong, 2.5–3 × 1.8–2 mm, rounded; stamens 2–3 mm; anthers green, 1.1–1.3 mm
Pistillate floral bracts	triangular, ca. 2 mm, acuminate	oblong to triangular, 0.9–1.1 mm, rounded
Staminate floral bracts	triangular, 2.2–2.5 mm, acuminate	oblong to elliptic, 0.7–1.2 mm, acute
Leaf sheaths	depressed-ovate, 3.2–4.7 × 4.9–6 cm	ovate to widely ovate or oblong, 3.5–6 × 4.2–6 cm
Distribution	Morelos, Puebla, and Oaxaca	Veracruz

acuminate, ca. 2 × 1.8 mm, slightly erose; *pistillate flowers* ascendant to adpressed, shortly pedicellate, pedicels 1.3–1.7 mm; *sepals* greenish brown, triangular, acute, 2.7–3.7 × 1.3–1.7 mm, entire; *petals* white, narrowly triangular, acute, 3.4–3.8 × 1.1–1.4 mm, entire; *ovary* green, ovoid to long-ovoid, 3.3–3.9 × 1.2–1.5 mm diam., glabrous, stigma branches 1–1.5 mm; staminodes 6, laminar, 1.6–1.8 mm, white, lacking anthers. *Capsule* narrowly ovoid to narrowly conical, pale brown, 8.5–10 × 3.2–4.3 mm diam.; *seeds* ellipsoid to oblong, 2.8–4 × ca. 1 mm diam., winged around seed circumference, the wing more conspicuous distally.

Distribution and habitat. *Hechtia caulescens* is known from the states of Morelos, Puebla, and Oaxaca, where it grows in arid scrub and tropical deciduous forest on rocky talus, slopes, and valleys, at altitudes of about 1200–1600 m.s.m., forming extensive colonies.

IUCN Red List category. The known populations of the *Hechtia caulescens* are widespread and usually form extensive colonies. Apparently, the plants are not used by the inhabitants of the region, thus we believe that the populations of *H. caulescens* are not subject to anthropogenic pressure. However, because of the absence of detailed information about the species distribution and precise population data we suggest the new species be considered Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Hechtia caulescens* has been collected in flower during July and August, and the fruits have been found in August.

Etymology. The specific epithet refers to the conspicuous, long, and prostrate to decumbent stems that characterize the new species.

Discussion. By its small white flowers and caulescent habit, *Hechtia caulescens* is phenetically similar to *H. stenopetala* Klotzsch, from which it differs by its larger flowers and floral bracts, its twice-branched inflorescence, and its distribution and habitat (Table 1). *Hechtia stenopetala* is endemic to the state of Veracruz, where it grows in oak forests and tropical (semi-)deciduous forests between 100 and 850 m.s.m. (Espejo et al., 2005).

Paratypes. MEXICO. **Morelos:** Mun. Jantetelco, Peñón de Chalcatzingo, ca. la zona arqueológica, 18°40′42″N, 98°46′19″W, 21 Aug. 1999, ♀, *A. Espejo, A. R. López-Ferrari, J. García-Cruz & R. Jiménez M. 5890* (UAMIZ [3]). **Oaxaca:** Distr. Huajuapan, Mun. Huajuapan de León, 5 km después de Huajuapan, rumbo a Juxtlahuaca, 17°45′32″N, 97°47′47″W, 21 jul. 2006, ♀, *N. Martínez C., A. Espejo, A. R. López-Ferrari & J. García-Cruz 65* (UAMIZ), ♂, *N. Martínez C., A. Espejo, A. R. López-Ferrari & J. García-Cruz 66* (UAMIZ); Mun. San Marcos Arteaga, 2 km adelante de San Marcos Arteaga, rumbo a Juxtlahuaca, 17°43′5″N, 97°52′21″W, 21 jul. 2006, ♂, *N. Martínez C., A. Espejo, A. R. López-Ferrari & J. García-Cruz 67* (UAMIZ [photos]), ♂, *N. Martínez C., A. Espejo, A. R. López-Ferrari & J. García-Cruz 68* (UAMIZ [illustration voucher]); Mun. Santiago Cacaloxtepec, 15.5 km después de Huajuapan de León, rumbo a Tamazulapan, 17°44′33″N, 97°42′34″W, 8 nov. 2004, ♀, *A. R. López-Ferrari, A. Espejo, J. Ceja & A. Mendoza R. 3131* (UAMIZ). **Puebla:** Mun. Acatlán, 15 km S of Acatlán, ♀, *Boutin & Hunt 3934* [seed cultivated at *Huntington Botanical Garden 34230*] (US); Mun. Guadalupe, paraje Río Grande (Río Mixteco) 3 km al SW de Chiltepec, 22 Aug. 1988, ♀, *A. Castañeda 223* (CHAP, MEXU, UAMIZ); Mun. Izúcar de Matamoros, 2 km adelante de El Tepenene, carr. Izúcar–Acatlán, 18°28′42″N, 98°23′20″W, 1235 m, selva baja caducifolia, 20 jul. 2006, ♂, *N. Martínez C., A. Espejo, A. R. López-Ferrari & J. García-Cruz 57* (UAMIZ).

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providing the facilities to consult specimens and data. The line illustration of the new species was drawn by Rolando Jiménez Machorro.

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Persea pallescens, a New Combination for *Phoebe pallescens* (Lauraceae, Perseeae), a Mistaken Taxon of Mexico and Guatemala

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Abstract. Critical review of the morphology of *Phoebe pallescens* Mez shows that the species must be placed in *Persea* Miller subgen. *Persea* (Lauraceae, Perseeae) because of the pinninerved leaves, absence of domatia, stipitate staminal glands, well-developed staminodia, the pubescent gynoecium, flat hypanthium not developed into a cupule, and perianth lobes entirely deciduous in fruit. The new combination *Persea pallescens* (Mez) Lorea-Hernández, which is distinguished by its straight, appressed pubescence on leaves, is not a rare, local endemic as previously considered, but occurs along the eastern Sierra Madre in Mexico and in central Guatemala. The name *Persea pallescens* is lectotypified, and a key to separate the Mesoamerican species of *Persea* with a pubescent pistil is provided.

Resumen. Con base en una revisión crítica de la morfología de *Phoebe pallescens* Mez se concluye que la especie debe ser considerada en *Persea* Miller subgen. *Persea* (Lauraceae, Perseeae), debido a sus hojas penninervadas, la ausencia de domacios, glándulas estaminales estipitadas, estaminodios bien desarrollados, el gineceo pubescente, hipanto plano que no se desarrolla como una cúpula y lóbulos del perianto deciduos en el fruto. La nueva combinación *Persea pallescens* (Mez) Lorea-Hernández, que se distingue por su pubescencia recta y adpresa sobre las hojas, no es un endemita local y raro, como anteriormente se le consideraba, sino que se distribuye a lo largo de la Sierra Madre Oriental en México y en el centro de Guatemala. Además se designa el lectotipo del nombre *Persea pallescens* y se presenta una clave para separar las especies de *Persea* con pistilo pubescente en Mesoamérica.

Key words: Guatemala, Lauraceae, Mexico, *Persea*, *Phoebe*.

In his review of the American Lauraceae, Mez (1889) described *Phoebe pallescens* Mez based on a single collection (*F. Müller 90*), which was gathered in the vicinity of Orizaba, Mexico. According to Mez, the species was unique among the 45 species of *Phoebe* Nees recognized by him in having a pubescent pistil. In subsequent reviews of the Mexican Lauraceae (Standley, 1922; Allen, 1945), the species was considered an endemic of very narrow distribution and known only from the type.

Later, Kostermans (1961) subsumed all the American species of *Phoebe* (including *P. pallescens*) under *Cinnamomum* Schaeffer, creating the name *C. pallescens* (Mez) Kostermans. However, a detailed study of the type material during a review of the Mexican species of *Cinnamomum* (Lorea-Hernández, 1997) showed that *F. Müller 90* belongs instead in *Persea* Miller. The pinninerved leaves, the absence of domatia in the axils of the secondary veins, the stipitate staminal glands, the well-developed staminodia, and the flat hypanthium not developed into a cupule firmly supported this generic affiliation. The flowers with tepals of similar form and size, the pubescent gynoecium, and the perianth lobes entirely deciduous in fruit place the species in *Persea* subgen. *Persea*.

Persea pallescens (Mez) Lorea-Hernández, comb. nov. Basionym: *Phoebe pallescens* Mez, Jahrb. Königl. Bot. Gart. Berlin 5: 218. 1889. *Cinnamomum pallescens* (Mez) Kostermans, Reinwardtia 6: 22. 1961. TYPE: Mexico. Veracruz: near Orizaba, 1853, *F. Müller 90* (lectotype, designated here, LE; isotypes, BR, K, NY).

Persea perglauca Lundell, Wrightia 5: 147. 1975. Syn. nov. TYPE: Guatemala. Baja Verapaz: Unión Barrios, 16 Apr. 1975, *C. L. Lundell & E. Contreras 19217* (holotype, LL not seen; isotypes, F, MO).

Persea parvifolia L. O. Williams, Econ. Bot. 31: 320. 1977. Syn. nov. TYPE: Mexico. Veracruz: above Tetla, Mun. Chocamán, 17 Oct. 1947, *L. O. Williams & F. W. Popenoe 13511* (holotype, EAP not seen; isotype, F).

The original material of *Persea pallescens* does not have mature open flowers, but only buds in different developmental stages, and the collected fruits were diseased. Therefore, part of the problem was to associate further collections of the species with open flowers and normal fruits with that of the type. Unfortunately, in the diagnosis and original description, Mez (1889) introduced an error when he described the species as having leaves and flowers

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glabrous. Examination of the type material showed that old leaves can sometimes be glabrous, but younger leaves are consistently sparsely appressed pubescent abaxially, as is the abaxial side of the tepals, particularly those of the inner whorl. The sparse, closely appressed pubescence of the abaxial leaf surface is, in fact, the principal character state that distinguishes this taxon.

The misleading presentation of the species by Mez has since contributed to an incorrect application of the name, and conspecific material subsequently collected around the type locality or from other areas has been overlooked. Most material of the species is filed in herbaria as *Persea americana* Miller, but this species has loose extended hairs forming the sparse to dense pubescence on its leaves. The same type of pubescence occurs in *P. schiedeana* Nees, the only other species of the subgenus *Persea* recognized by Kopp (1966) in America that has not been considered synonymous with *P. americana* (van der Werff, 2002). In searching for a possible previous name or synonyms of *P. pallescens* in *Persea*, careful examination of the types for synonyms of *P. americana* was undertaken, including *P. drymifolia* Schlechtendal & Chamisso, *P. floccosa* Mez, *P. gigantea* L. O. Williams, *P. gratissima* C. F. Gaertner var. *oblonga* Meisner, *P. nubigena* L. O. Williams, *P. paucitriplinervia* Lundell, and *P. steyermarkii* C. K. Allen. Except for the type of *P. steyermarkii*, all these types share rather erect, sinuous trichomes on the abaxial leaf surfaces, sometimes sparse, sometimes dense. Leaves of the type of *P. steyermarkii* are entirely glabrous, but its inflorescence axes and flowers have extended, sinuous trichomes. In addition, the inflorescence structure in *P. steyermarkii* is botryoid, whereas in *P. pallescens* it is thyrsoid. Thus, none of the binomials mentioned above correspond to the taxonomic concept of *P. pallescens*.

A review of other type material in *Persea* from Mexico and the Mesoamerican region resulted in the recognition of *P. perglauca* Lundell and *P. parvifolia* as additional, novel synonyms of *P. pallescens*. *Persea perglauca* was differentiated (Lundell, 1975) by the combination of glaucous abaxial leaf surfaces, short inflorescences (up to 2 cm), and small flowers (ca. 2 mm long), all of which are characters that correspond to *P. pallescens*. The glaucous bark of the twigs, considered typical of *P. perglauca* by van der Werff (2002), is not such; although it is not seen frequently, the feature is certainly present in some specimens (mainly from Oaxaca) of *P. pallescens*. Other than that, there are not additional characters to distinguish *P. perglauca* from *P. pallescens*. The two species are similar in leaf shape (elliptic with apex acute to short acuminate and base cuneate) and size (7–12 × 2.5–4 cm), in inflorescence and flowers (discussed above), in the abaxial surfaces of young leaves and tepals that are characteristically appressed pubescent, and in the pubescent pistil.

In the case of *Persea parvifolia*, Williams (1977) pointed out the glabrous condition of the leaves and ovary as two of the distinctive features of the species. However, a careful inspection of the type material showed that he overlooked the sparse appressed pubescence of the abaxial leaf surface and the long scattered hairs of the pistil. The size and shape of the leaves as well as inflorescence and flower morphology also correspond to *P. pallescens*. It is worth mentioning that Tetla, the place where the type of *P. parvifolia* was collected, is just 13 km north of Orizaba, the approximate source area of *P. pallescens* type material.

During the survey of type material involved in this work, it was noticed that no holotype was designated for *Persea pallescens*. Mez (1889: 218) cited two specimens of the collection *F. Müller 90*, one from the herbarium of the Vienna Natural History Museum (W), the other from the herbarium of the Russian Academy of Sciences (LE). The syntype at W was destroyed during World War II, and I therefore designate the extant specimen at LE as the lectotype.

According to data recovered from herbarium specimens, *Persea pallescens* is a small tree (mainly 4–8[18] m) found frequently in mixed montane forests of the eastern Sierra Madre in Mexico (San Luis Potosí, Hidalgo, Querétaro, Puebla, Veracruz, and Oaxaca), growing mostly between 1650 and 1900 m on limestone-derived soils. The species is disjunct in central Guatemala, growing in the eastern mountains of Baja Verapaz. Flowering occurs from March to April, and mature fruits are found in the autumn and winter. The fruit is 3–3.5 cm in diam. and round or slightly pyriform in shape.

Specimens examined. GUATEMALA. **Baja Verapaz:** Unión Barrios, E of Km 154, *C. L. Lundell & E. Contreras 19217* (F, MO). MEXICO. **Hidalgo:** 3.5 km al N de Ixtlahuaco, *S. Montes 51* (XAL). **Oaxaca:** 16 km al W de Totontepec, *E. Ramírez 549* (MEXU, MO, NY); 7 km al E de Totontepec, *E. Ramírez 357* (MEXU, MO); 11 km al N de Totontepec, *R. Torres 10429* (MEXU, MO); Totontepec, *J. Rivera 189* (MEXU, MO); Cerro Horqueta, San Pedro Ocotepec, *J. Rivera, S. Salas & L. Schibli 537* (XAL); 39 km al S de Valle Nacional, *J. Rzedowski 34025* (ENCB, XAL); 2.5 km al E de Tanetze, *R. Aguilar 878* (OAX, XAL); entre La Laguna y brecha límite de Talea, *S. Acosta 2774* (OAX, XAL); 3 km al SW de La Esperanza, *A. Rincón 524* (MEXU, XAL); 9.5 km E of the Mitla–Choapam rd. on rd. to Zacatepec, *D. Breedlove 64755* (CAS); a 200 m de Plan de Guadalupe, por la terracería a San Martín Zoquiapan, *X. Munn 2018* (XAL). **Puebla:** Tetelilla, Barranca del Río Tozán, *E. Meza 314* (XAL); 4 km al N de Tetelilla, Hueyapan, *J. L. Contreras 4488* (XAL). **Querétaro:** 1.5 km al SE de El Pemoche, Landa de Matamoros, *H.*

Rubio 2245 (IEB, MO, XAL); same locality, *H. Rubio 2326* (IEB, XAL). **San Luis Potosí:** 5 km al NE de Ahuacatlán, *J. Rzedowski 10070* (ENCB, XAL). **Veracruz:** Alseseca, *F. Ventura 18363* (MO, XAL); Cerro La Cima, entre Plan de Las Hayas y Tierra Blanca, *G. Castillo & H. Narave 2168* (XAL); Cerro San Cristóbal, 5 km al SW de Orizaba, *J. Rzedowski 12183* (ENCB, XAL); cerca de Apanga, Zongolica, *A. Rincón 1354* (XAL); La Cima, Plan de Las Hayas, *R. Hernández 1588* (MEXU).

KEY TO MESOAMERICAN SPECIES OF *PERSEA* WITH A PUBESCENT PISTIL

1a. Pubescence of abaxial leaf surface made of minute, straight appressed hairs, scattered (better seen on young leaves) . . . . . *P. pallescens*
1b. Pubescence of abaxial leaf surface made of rather erect sinuous hairs, mostly noticeable by the naked eye (particularly on young leaves), scattered to dense 2
2a. Bracts at the base of the inflorescences lanceolate to ovate; staminode apex trullate to ovate in outline. . . . . *P. americana*
2b. Bracts at the base of the inflorescences widely ovate to depressed ovate; staminode apex elliptic to lanceolate in outline . . . . . *P. schiedeana*

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Parkia nana (Leguminosae, Mimosoideae), a New Species from the Sub-Andean Sandstone Cordilleras of Peru

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Abstract. *Parkia nana* D. A. Neill (Leguminosae, Mimosoideae) from sandstone areas near the Río Marañón area in northeastern Peru is described and illustrated. Photographic evidence also indicates presence of this species on sandstone substrate in the Cordillera Azul in east-central Peru. Compared to other species of *Parkia* R. Brown, which commonly attain 30–40 m in height, *P. nana* has a dwarf growth form, found as a pachycaul treelet attaining reproductive maturity at 3–4 m in height. The new species is placed in the pantropical section *Parkia* R. Brown and is similar to *P. nitida* Miquel and *P. balslevii* H. C. Hopkins, with which it shares the opposite to subopposite leaves, the biglobose capitula, and indehiscent strap-shaped pods, but differs from both in its short stature, erect compound inflorescence, and erect, velutinous fruits.

Resumen. Se describe y se ilustra *Parkia nana* D. A. Neill (Leguminosae, Mimosoideae) procedente de mesetas de arenisca cerca al Río Marañón en el nororiente del Perú. Evidencia fotográfica además indica la presencia de esta especie en substrato de arenisca en la Cordillera Azul en el centro-oriente del Perú. A diferencia con otras especies de *Parkia* R. Brown, que frecuentemente alcanzan 30–40 m de alto, *P. nana* tiene una forma de crecimiento enana, es un arbolito poco ramificado que llega a la madurez reproductiva a la estatura de 3–4 m. La especie nueva se ubica en la sección *Parkia* R. Brown, que tiene una distribución pantropical, y es similar a *P. nitida* Miquel y *P. balslevii* H. C. Hopkins, especies con las cuales comparte las hojas opuestas a subopuestas, las cabezuelas biglobosas, y las vainas indehiscentes y planas, pero con las cuales difiere en su estatura baja, su inflorescencia compuesta erecta, y sus frutos erectos y vellosos.

Key words: IUCN Red List, Leguminosae, Mimosoideae, *Parkia*, Peru, sandstone.

The genus *Parkia* R. Brown, comprising some 35 species of trees, has a broad pantropical distribution with three disjunct centers of diversity including the Neotropics (centered in lowland Amazonia), Africa–Madagascar, and tropical Asia–Oceania (Lewis et al., 2005). Of the three sections of *Parkia*, only the largest, section *Parkia* R. Brown, is pantropical, including all of the 16 Paleotropical species and more than half of the 19 or more Neotropical species; sections *Sphaeroparkia* Ducke and *Platyparkia* Ducke are exclusively Neotropical and restricted to the Amazon region (Hopkins, 1986, 2000a, b, 2001).

In *Parkia* the individual flowers are tightly massed into globose, pyriform, or biglobose heads, known as capitula, and these partial inflorescences are grouped into branched compound inflorescences. In section *Parkia* there are three types of flower in each capitulum: (1) fertile flowers at the globose, swollen apex of the receptacle, (2) nectar-secreting flowers in the middle, in a ring below the fertile ones, and (3) staminodial flowers at the base. The compound inflorescences are generally borne outside of the leaf-crown, either above the crown and erect or below the crown and pendent. Species of *Parkia* are pollinated by bats in the Neotropics and Paleotropics (Baker & Harris, 1957; Baker, 1973; Hopkins, 1984), and the floral and inflorescence structures are considered to be adaptations to chiropterophily (but the three Amazonian species of section *Sphaeroparkia* are partially or entirely entomophilous; Hopkins, 1986).

Most species of *Parkia* throughout the pantropical range of the genus are large trees that attain 30 m or more in height in the canopy, or even taller emergents above the canopy, in lowland tropical forests. A few species that grow in reduced-stature vegetation types on nutrient-poor soils are much smaller trees. *Parkia cachimboensis* H. C. Hopkins is a small tree or shrub that attains just 5 m in height and grows exclusively in nutrient-deficient, highly acidic sand or sandstone, in low scrubby vegetation known as white-sand campina or Amazon caatinga (Anderson, 1981) in the Tapajós region of Pará, Brazil (Hopkins, 1986). Similarly, *P. lutea* H. C. Hopkins (Hopkins, 2000a) is a small tree 5–10 m tall, occurring on lowland white-sand campina in central Amazonia (Amazonas, Brazil, near the mouth of the Río Madeira). A third species of *Parkia* that grows as a small tree is *P. barnebyana* H.

C. Hopkins (Hopkins, 2000b, 2001) from the upper Río Negro region of the Venezuelan Guayana. The label information indicates that *P. barnebyana* attains just 7–9 m in height, and like *P. cachimboensis* and *P. lutea*, it may be endemic to lowland white-sand scrub, but the soil type is not indicated on the specimen labels of the two known collections.

Recent collections from the sub-Andean sandstone plateaus in the Río Marañón region of Amazonas Department, Peru, have revealed a fourth dwarf species of *Parkia*, in section *Parkia*, that is evidently restricted to the nutrient-poor sandstone substrate and has a limited distribution in this habitat type in westernmost Amazonia.

Parkia nana D. A. Neill, sp. nov. TYPE: Peru. Amazonas: Bagua District, Imaza, Tayu Mujaji, Comunidad Nativa de Wawas, bosque primario, vegetación de 2 m de alto promedio (Uwejush), 1100 m, 05°15′S, 78°02′W, 7 Feb. 1999 (fl., immature fr.), *R. Vásquez, C. Vargas, J. Yactayo & E. Palomino 26063* (holotype, USM 181801; isotypes, MO 5593805, MO 5593806). Figure 1.

Haec species *Parkiae nitidae* Miquel et *P. balslevii* H. C. Hopkins foliis oppositis vel suboppositis, inflorescentiis biglobosis et legumine ligulato indehiscente similis, sed ab eis habitu humiliore (arboris parvae 3–4 m altae), inflorescentiis erectis et fructibus velutinis recedit.

Small tree or shrub, sparsely branched, with erect or ascending branches, 3–4 m tall; branchlets, petiole, and rachises with brownish ferruginous pubescence of short simple hairs. Leaves bipinnate, opposite or subopposite, (9–)11–15 cm, with swollen basal pulvinus; petiole 2.5–3.5 cm; rachis 5–9 cm; petiole bearing a single shallow, inconspicuous elliptic gland, ca. 3 × 1.5 mm, on abaxial side, ca. halfway from the base to the first pair of pinnae; pinnae 8 to 10 in pairs, opposite to subopposite; leaflets 16 to 28 pairs per pinna, oblong, 2–6 × ca. 1 mm, the length of the leaflets gradually diminishing at the distal end of the pinna to a minimum of 2 mm long at the distal end versus ca. 6 mm in the central and basal portions of the pinna; apex of leaflet rounded, the base auriculate on the proximal side; main nerve of leaflet central and straight at apex. Compound inflorescence axis erect, projecting above foliage, ca. 10–12 cm long; peduncles in 3 or 4 pairs, opposite and decussate along erect compound inflorescence axis, ascending at an angle, ca. 4–6 cm long; capitula yellow, ca. 3–4(–5) cm, biglobose, the basal fringe of staminodial flowers ca. 3.5–4 cm diam., the apical portion ellipsoid, ca. 2–2.5 cm diam. Hermaphrodite (apical) flowers: calyx ca. 4 mm, the 5 lobes ca. 0.5 mm long, minutely pubescent; corolla ca. 5–5.5 mm, the 5 lobes ca. 0.5 mm long, minutely pubescent; the 10 stamens exserted ca. 10 mm beyond corolla. Nectar-secreting (midportion) flowers similar in size to hermaphroditic flowers. Staminodial (basal) flowers: calyx ca. 6 mm, with rounded lobes ca. 1 mm long, minutely pubescent; corolla ca. 9–10 mm, lobes ca. 1–1.5 mm long, filaments exserted to ca. 18–20 mm beyond corolla. Immature pods strap-shaped, with dense ferruginous to brownish velutinous pubescence; mature pods (seen only in photographs; no specimens available) borne erect or ascending on erect compound inflorescence, above foliage, indehiscent, estimated to be ca. 12–20 × 3–4 cm, with ferruginous to brownish velutinous pubescence evident in photographs. Seeds elliptic, glossy black, seen only in photographs.

Distribution and habitat. Herbarium specimens of *Parkia nana* have been obtained only from a small area in the Bagua District, Amazonas Province, Peru, in territory owned by indigenous Aguaruna communities in the vicinity of the settlement of Imaza. This area is a few kilometers east of the Río Marañón where the river flows through a region of sandstone outcrops above the river valley, near the union of the Marañón and one of its right bank tributaries, the Río Imaza (or Río Chiriaco), at about 05°15′S, 78°22′W. Both of the known collections were made from low shrubby vegetation atop sandstone plateaus or ridges, at 900–1100 m in elevation.

Photographic evidence and site records, however, suggest that *Parkia nana* also occurs on sub-Andean sandstone mountains about 350 km farther to the south of the type locality, in east-central Peru. Biologists, including botanists from the herbaria of the Field Museum of Chicago (F) and the Universidad Nacional Mayor de San Marcos in Lima (USM), carried out a "Rapid Biological Inventory" of the Cordillera Azul National Park along the boundary between San Martín and Loreto departments, between the Ucayali and Huallaga rivers (Alverson et al., 2001). On the high sandstone ridges of the Cordillera Azul, at 1400 m elevation, about 07°34′S, 75°31′W, Robin Foster photographed a small *Parkia* about 3 m tall with opposite leaves and erect, evidently velutinous brown fruits and black seeds. Taking note of those features, he wrote in the expedition report (Alverson et al., 2001) that the dwarf *Parkia* was a new species distinguished by its small stature and erect fruits. Herbarium specimens were not collected on the F/USM Cordillera Azul expedition, but the photographs were posted on the Internet site of the Field Museum, <www.fmnh.org/plantguides>. I believe the images of the dwarf *Parkia* from the Cordillera Azul almost certainly represent another population of *P. nana*. There are a number of

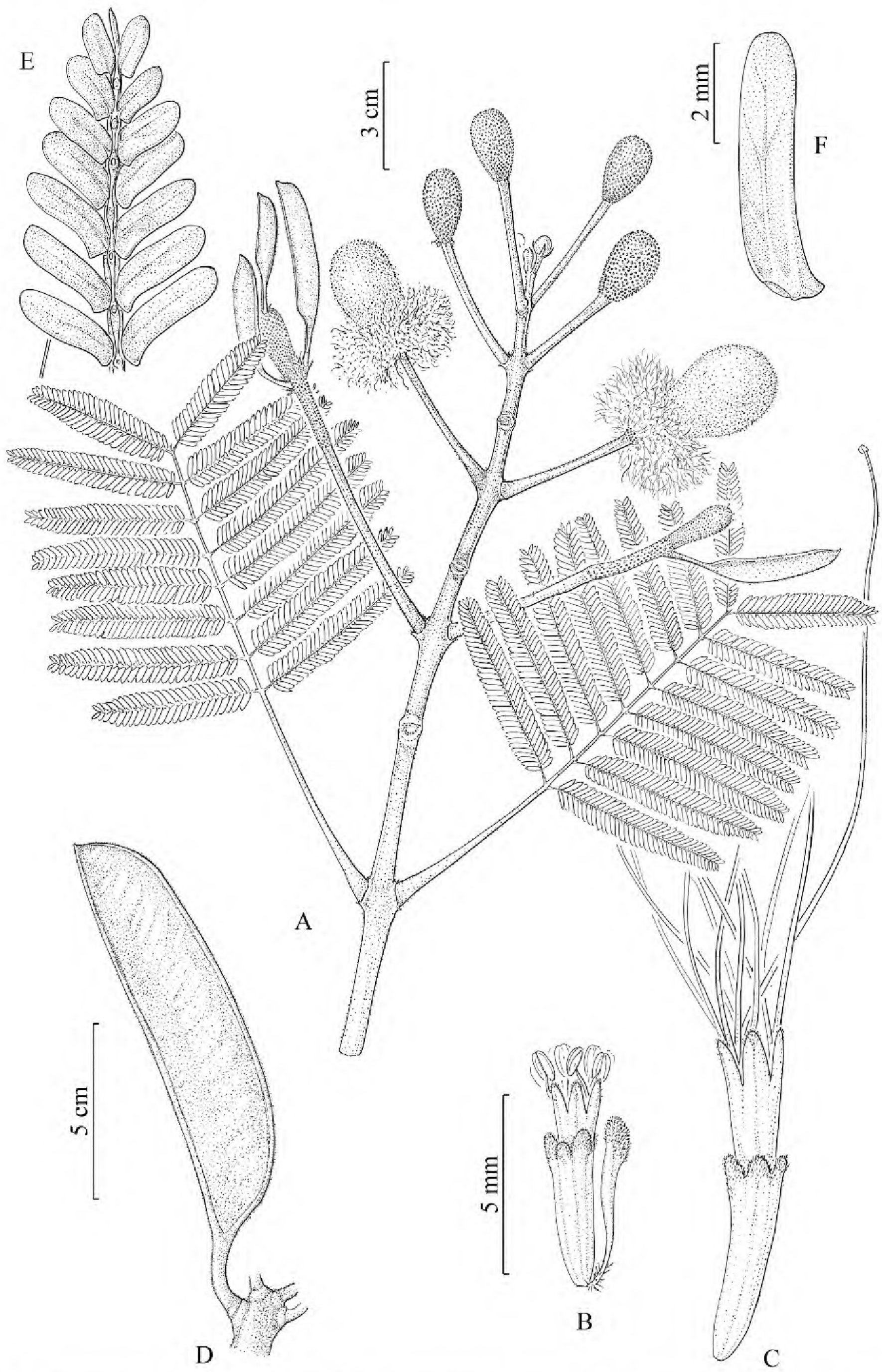

Figure 1. *Parkia nana* D. A. Neill. —A. Branchlet with a terminal, compound inflorescence and young fruits. —B. Fertile flower from the apical portion of the capitulum. —C. Staminodial flower from the basal portion of the capitulum. Scale bar for B also applies to C. —D. Nearly mature fruit. —E. Distal end of pinna with leaflets. (Detail from part A.) —F. Leaflet. A–C and E–F drawn from the type and paratype, *R. Vásquez et al. 26063* and *R. Vásquez 27597* (MO); D from photographs taken by Robin Foster of a tree in the Cordillera Azul, Loreto Department, Peru, and posted on the Internet at <www.fmnh.org/plantguides>.

sandstone outcrops in eastern Peru, most of which have not been explored at all botanically, where this species is also likely to occur; in addition, it is likely to occur on the lower elevation sandstone ridges of the Cordillera del Cóndor in southeastern Ecuador (Neill, 2005), where *P. nana* has not been found as yet.

Ecologically, *Parkia nana* appears to be restricted to the low scrub vegetation or dwarf forest that occurs exclusively on sandstone outcrops in sub-Andean cordilleras below 1500 m elevation, at the extreme western edge of the Amazon Basin in Peru. These sandstone outcrops form an "archipelago" of isolated, edaphically distinct habitat islands that vary from a few hectares in size to tens of thousands of hectares. The floras of very few of these sandstone cordilleras have been inventoried as yet, and none have been explored thoroughly, but ongoing studies in Ecuador and Peru have revealed that many trees and shrubs in the sandstone dwarf forests are restricted to that habitat; some are local endemics (Neill, 2005) and some are more widespread in the lowland white-sand campinas or "Amazon caatingas" that are scattered throughout the Amazon Basin (Anderson, 1981).

IUCN Red List category. *Parkia nana* is known with certainty from a single locality that is not formally protected, and the presumed record of a protected population in Cordillera Azul National Park is based only on photographic evidence. This species is believed to be ecologically restricted to sandstone substrates, which are scattered as isolated habitat islands in the sub-Andean cordilleras of eastern Peru. The population size, extent of occurrence, and area of occupancy of *P. nana*, criteria used in the IUCN Red List categories for threatened species (IUCN, 2001), are not known to any degree of precision. In general, the natural vegetation on these isolated sandstone outcrops in Peru and Ecuador is not highly threatened at present because these sites are relatively difficult to access, are not suitable for agriculture, and are usually not subject to deforestation by rural inhabitants in this region. However, because the total population of this species is expected to be relatively small, fragmented, and ecologically restricted, migration to other areas under future conditions of climate change may not be possible, and increased alteration of forest habitats in eastern Peru by agriculture, mining, or other human activities may take place in the future, the IUCN Red List category of Near Threatened (NT) is assigned to this species. *Parkia nana* is clearly not, by any measure, widespread and abundant, which are criteria for the IUCN category of Least Concern (LC).

Etymology. The specific epithet, Latin meaning "dwarf," refers to the unusually small stature of *Parkia nana*, in comparison with most other species of *Parkia*, which are tall canopy emergent trees.

Discussion. Within section *Parkia*, *P. nana* is most similar to the widespread *P. nitida* and *P. balslevii*, known only from Amazonian Ecuador. Both of the latter species share several features with *P. nana*, including the opposite to subopposite leaves, biglobose capitula, and strap-shaped indehiscent pods. *Parkia nitida* and *P. balslevii*, however, are large canopy emergent trees attaining 30–40 m in height, and the compound inflorescences in both species are pendent, hanging below the leafy crown of the tree, with the capitula pendent from long peduncles. The capitula of *P. nana* are yellow like those of *P. nitida*, whereas those of *P. balslevii* are pinkish red. The strap-shaped indehiscent pods of all three species are similar, but those of *P. nitida* and *P. balslevii* are glabrous, whereas those of *P. nana* bear a velutinous pubescence similar to the pods of the more distantly related *P. velutina* Benoist, in section *Sphaeroparkia*, which is widespread in lowland Amazonia.

Paratype. PERU. **Amazonas**: Bagua Distr., Imaza, Tayu Mujaji, bosque primario, 05°15′56″S, 78°22′07″W, 900–1030 m, 17 Feb. 2002, *R. Vásquez 27597* (fl., imm. fr.), (MO, USM not seen).

Both the type and the paratype were originally determined by the author as *Parkia nitida* Miquel, and duplicates under that name may have been distributed from MO to other herbaria.

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A Tiny New Brazilian Species of *Diandrolyra* (Poaceae, Bambusoideae, Olyreae), with Notes on the Systematics of the Genus

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Abstract. A new species of *Diandrolyra* Stapf (Poaceae, Bambusoideae, Olyreae), *D. pygmaea* Soderstrom & Zuloaga ex R. P. Oliveira & L. G. Clark, from Bahia, Brazil, is described and illustrated. This species is known only from southern Bahia, growing in the Atlantic Forest region. It is compared and contrasted with its congeners, *D. bicolor* Stapf and *D. tatianae* Soderstrom & Zuloaga, and the Bahian distribution of the three species is mapped. Distinguishing features of *D. pygmaea* include its small stature and two (or three) pairs of spikelets per racemose inflorescence.

Resumo. Uma nova espécie de *Diandrolyra* Stapf (Poaceae, Bambusoideae, Olyreae), *D. pygmaea* Soderstrom & Zuloaga ex R. P. Oliveira & L. G. Clark, para a Bahia, Brazil, está sendo descrita e ilustrada. Esta espécie é conhecida apenas para o sudeste da Bahia, crescendo em áreas de Mata Atlântica higrófila. Está sendo comparada com as outras espécies congenéricas, *D. bicolor* Stapf e *D. tatianae* Soderstrom & Zuloaga, e a distribuição das três espécies na Bahia é mapeada. Características distintivas de *D. pygmaea* incluem sua pequena estatura e dois (ou três) pares de espiguetas por inflorescência racemosa.

Key words: Atlantic rainforest, Bahia, Bambusoideae, Brazil, *Diandrolyra*, IUCN Red List, Olyreae, Poaceae.

Diandrolyra is a rare grass genus, described by Stapf (1906). The generic name refers to the reduced stamen number, from three (as occurs in other genera of Olyreae, e.g., *Olyra* L., *Cryptochloa* Swallen, and *Raddia* Bertoloni) to two. This genus is also distinguished from other herbaceous bamboos by flowering culms typically bearing only one fully developed and specialized leaf blade, which is appressed to and overtops the single contracted inflorescence (Judziewicz et al., 1999). This inflorescence is inconspicuous and completely hidden under the abaxial surface of the leaf blade when the plant is viewed from above, which makes *Diandrolyra* species appear to always be sterile (Fig. 1D).

Based on the presence of often raceme-like inflorescences borne on specialized culms (Fig. 1B, C, E), Clayton and Renvoize (1986) considered *Diandrolyra* to belong to a group including *Piresia* Swallen, which is disjunct between the Amazon Basin and the Atlantic Forest region, as well as *Mniochloa* Chase and *Ekmanochloa* Hitchcock, endemics to Cuba, and *Buergersiochloa* Pilger, endemic to New Guinea. Among these genera, *Piresia* was consistently indicated as most related to *Diandrolyra* (Soderstrom & Calderón, 1974; Clayton & Renvoize, 1986), principally due to the presence of polygamous spikelets with incomplete sexual separation (female spikelets with staminodes and male spikelets with a sterile ovary bearing three stigmas).

Preliminary molecular studies in the tribe Olyreae (Oliveira, 2006), however, do not support a relationship between *Diandrolyra* and *Piresia*. ITS sequence data provide weak support for a sister relationship between *Diandrolyra* and *Cryptochloa capillata* (Trinius) Soderstrom, which has conspicuously dimorphic male and female spikelets. However, plastid *trnD-trnT* sequence data used in the same work (Oliveira, 2006) strongly support *Diandrolyra* as sister to a clade containing *Parodiolyra* Soderstrom & Zuloaga and *Raddiella* Swallen.

Diandrolyra is endemic to the Atlantic Forest of Brazil, from Bahia to São Paulo (Soderstrom et al., 1988; Clark, 1990), occurring in lowlands below 400 m, often in very shaded areas, sometimes near running water. Only two species are presently formally

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Figure 1. —A. Atlantic mesophyllous forest at Itanhém, Bahia, Brazil. —B. *Diandrolyra pygmaea*. —C. *Diandrolyra bicolor*. —D, E. *Diandrolyra tatianae*. Photos: A, B by André M. Amorim; C–E by R. P. Oliveira. Scale bars = 5 cm.

described, *D. bicolor* Stapf (Fig. 1C), occurring in Bahia, Espírito Santo, and Rio de Janeiro states, and *D. tatianae* Soderstrom & Zuloaga (Fig. 1D, E), which has a wider distribution, known from São Paulo, Rio de Janeiro, Espírito Santo, Minas Gerais, and Bahia states (Oliveira, 2001). Estimates have given possibly as many as five (Soderstrom & Zuloaga, 1985) or six species (Clayton & Renvoize, 1986) for this taxonomically difficult genus, as each of the two described species are not well defined morphologically and more

than one taxon may be included in their current circumscriptions (Oliveira et al., 2006).

Thomas Soderstrom and colleagues first became interested in Olyreae, including *Diandrolyra*, in the 1960s (Calderón & Soderstrom, 1967). They initiated a systematic revision of this genus in the 1970s as part of their studies on Neotropical Bambusoideae. Several new species among olyroid genera were proposed by these authors, but they were not published before Soderstrom's untimely death (1936–1987). Soderstrom (1984) showed a photograph of and informally mentioned a third, tiny and small-leaved new species of *Diandrolyra* from Bahia, which was also commented on in Soderstrom and Zuloaga (1985).

During a floristic survey of Olyreae from the state of Bahia (Oliveira, 2001), several herbarium specimens were found annotated as *Diandrolyra pygmaea* by Soderstrom and Zuloaga, and a recent collection was made from the only population of this species still known to exist. We herein validate this taxon and discuss its conservation status. Information on the occurrence of other *Diandrolyra* species in Bahia is based on Oliveira (2001).

KEY TO THE SPECIES OF *DIANDROLYRA*

1a. Vegetative culms 8.5–19 cm tall; leaf blades of vegetative culms 1.8–3(–4) × 0.2–0.8 cm; leaf blades of flowering culms 1.7–2.9 × 0.3–0.5 cm; racemes with 2(3) pairs of spikelets . . . . . *D. pygmaea*

1b. Vegetative culms 15–50 cm tall; leaf blades of vegetative culms 6–16 × 1–4.5 cm; leaf blades of flowering culms 3–6.2 × 0.9–1.6 cm; racemes with 4 to 6 pairs of spikelets 2

2a. Racemes with 5 or 6 pairs of spikelets; leaf blades often pale green, glabrous; leaf blades of vegetative culms 8.5–16 × (2–)2.7–4.5 cm; lemma of male spikelet scabrous or glabrous . . . . . .*D. tatianae*

2b. Racemes with 4 pairs of spikelets; leaf blades strongly bicolored, pilose on the abaxial surface; leaf blades of vegetative culms 6–8(–11) × 1–2 (–2.5) cm; lemma of male spikelet sparsely pilose . . . . . .*D. bicolor*

Diandrolyra pygmaea Soderstrom & Zuloaga ex R. P. Oliveira & L. G. Clark, sp. nov. TYPE: Brazil. Bahia: Itabuna, on rd. Ilheus–Itabuna, area da CEPLAC [Centro de Pesquisas do Cacau], 1 May 1976, *C. E. Calderón, T. S. Santos & L. B. Oliveira 2407* (holotype, CEPEC; isotypes, INPA, US). Figures 1B, 2.

Haec species a congeneris planta minore (8.5–19 cm alta), laminis foliaribus minoribus (eis culmorum vegetativorum 1.8–3[–4] cm longis) et racemo ex 2(3) paribus tantum spicularum constante differt.

Plants caespitose, without rhizomes; vegetative culms 8.5–19 cm, 0.6–1 mm diam., shortly pilose, with 4 to 8 leaves, green on both surfaces, nodes scabrous or puberulent; flowering culms 4–7 cm, 0.5–1 mm diam., scabrous, bearing 1 or rarely 2 leaves, green on both surfaces, nodes scabrous or puberulent. Leaf sheaths glabrous or sometimes fully pilose; leaf blades of vegetative culms 1.8–3(–4) × 0.2–0.8 cm, those of the flowering culms 1.7–2.9 × 0.3–0.5 cm, lanceolate, glabrous on both surfaces or pilose only on the abaxial surface, base symmetrical or slightly asymmetrical, rounded, margins scabrous, apex acute; pseudopetiole 0.5–1 mm, hirsute on both surfaces; ligule 0.2–0.3 mm; sheath auricles absent. Inflorescence a raceme 0.7–1 cm, with 2(3) pairs of female and bisexual but functionally male spikelets, with a male at the apex, these borne on one side of the axis; axis glabrous. Female spikelets 4.8–5 × 1.4–1.6 mm, ovoid or ellipsoid, acute, the base of the glumes fused, thickened, and presenting a tuft of hairs; pedicel shortly pilose; glumes 4.5–5 mm, membranous, subequal, acute, sparsely pilose, especially at the base and on the nerves, 5- to 7-nerved; anthecium 4–4.3 × 1.2–1.5 mm, ovoid-ellipsoid, stramineous; lodicules 3, conspicuous; staminodes absent; caryopsis ellipsoid, ca. 3 × 1 mm, hilum linear, as long as the caryopsis. Male spikelets similar but ca. 3 × 0.5 mm, lanceolate; glumes very short, not fused, and without a tuft of hairs, sparsely pilose, 5-nerved; lemma acuminate, sparsely pilose, 3-nerved; lodicules 3, conspicuous; stamens 2, anthers 0.6–0.8 mm; pistillodes present.

Distribution and habitat. Plants of *Diandrolyra pygmaea* are very delicate, and the species is distinguished from its congeners by its small height and reduced number of leaf blades, as well as the small number of spikelet pairs in each raceme. This species is endemic to southern Bahia, where the other two *Diandrolyra* species also occur (Fig. 3). This new species was found in humid forests along with ferns and other small herbaceous plants, but it is also found in transitional to mesophyllous forest at the Itanhém site (Fig. 1A). It prefers shady, humid places and persists under trees of *Theobroma cacao* L. plantations.

IUCN Red List category. *Diandrolyra pygmaea* is known from only two localities in southern Bahia, and only the population from Itanhém has been found during recent field trips. The populations collected by Calderón and Soderstrom were not relocated and are possibly now destroyed, because the native forest has been converted to ample areas of grasslands. For these reasons, we suggest that *D. pygmaea* should be considered Critically Endangered (CR) according to IUCN Red List criteria (IUCN, 2001), as has been recently proposed for several other herbaceous bamboos occurring in this same

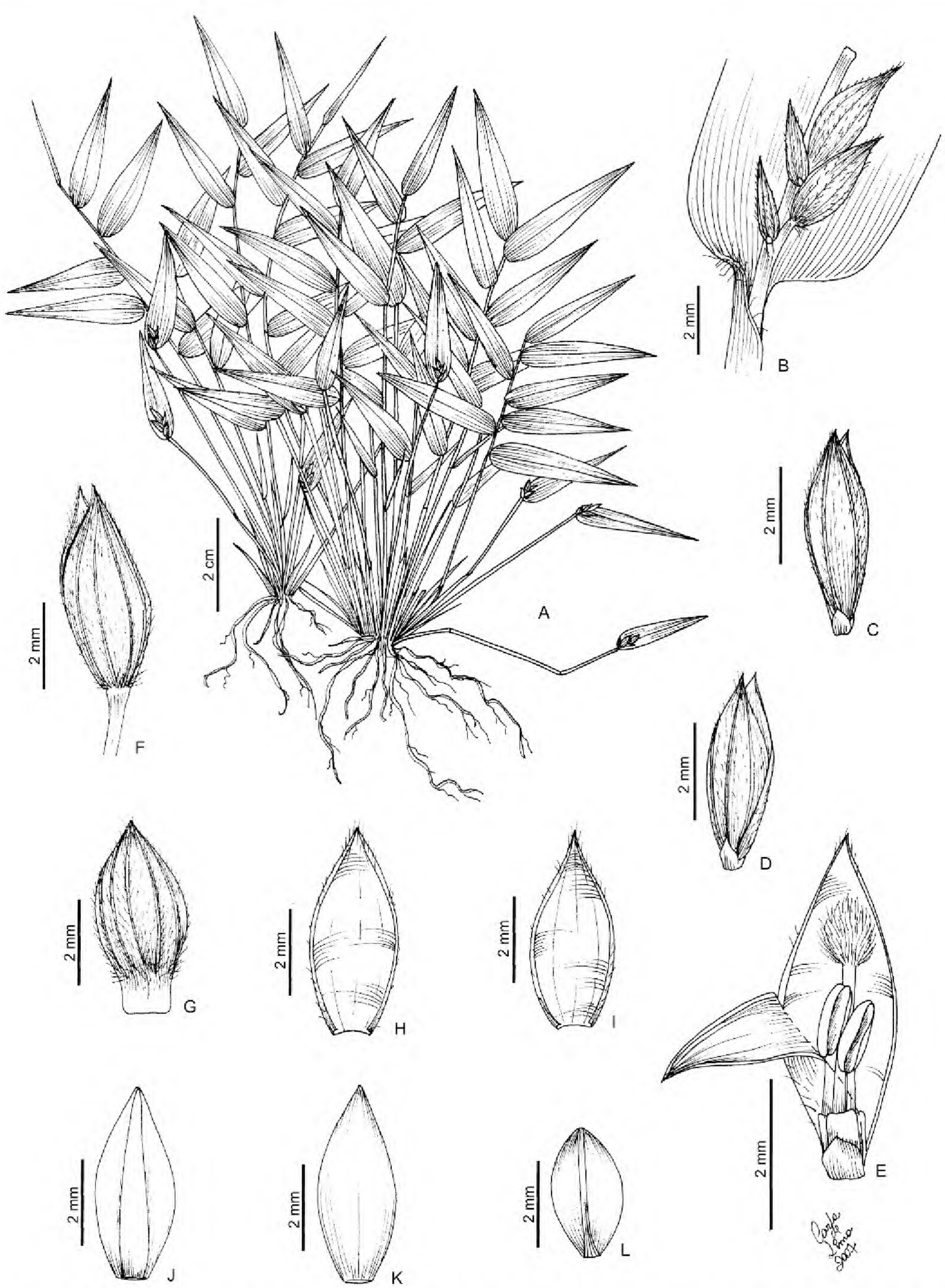

Figure 2. *Diandrolyra pygmaea* Soderstrom & Zuloaga ex R. P. Oliveira & L. G. Clark. —A. Habit. —B. Detail of the inflorescence near the base of the leaf blade, showing two pairs of spikelets (on left, the bisexual and functionally male, and right, the female ones). —C, D. Male spikelet (bisexual, but functionally male) closed, dorsal view. —E. Male spikelet opened, showing two stamens, three lodicules, and reduced female structures of stigma and style (without ovary developed). —F, G. Female spikelets closed, dorsal view. —H, I. Glumes of the female spikelets, ventral view. —J. Female anthecium, ventral view. —K. Female anthecium, dorsal view. —L. Caryopsis with linear hilum. Drawn from the holotype *C. E. Calderón et al. 2407* (CEPEC), by Carla de Lima.

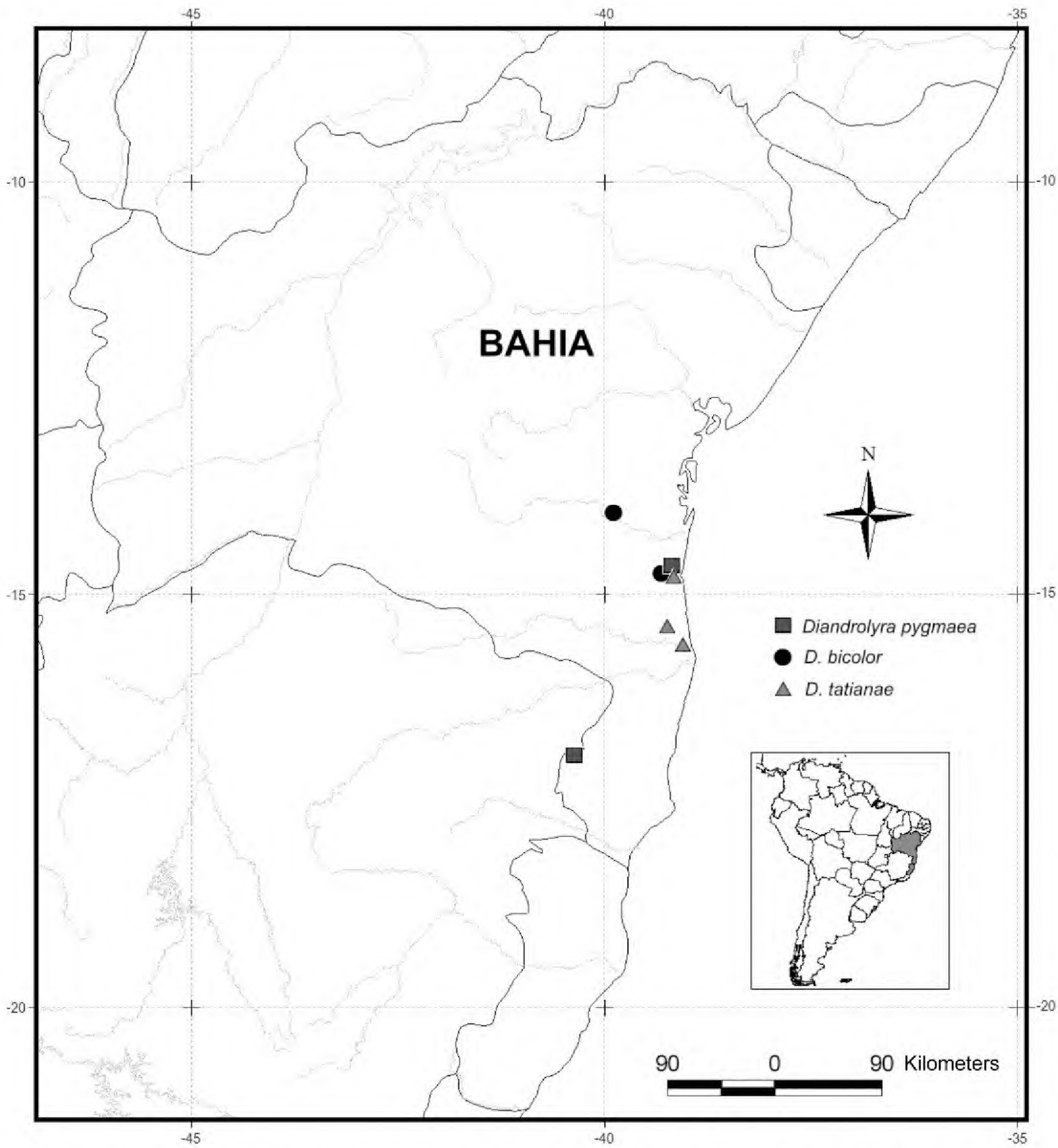

Figure 3. Distribution map of *Diandrolyra pygmaea* and other congeneric species occurring in Bahia, Brazil.

region (Oliveira et al., 2004; Oliveira & Longhi-Wagner, 2005).

Paratypes. BRAZIL. **Bahia:** Ilhéus, Area do CEPLAC, Km 22 Rod. Ilhéus–Itabuna (BR 415), 50 m, 29 Oct. 1983, *T. S. Santos & T. R. Soderstrom 3917* (ISC, US); Itabuna, Ferradas, Faz. Aberta Grande, 14 km SW of Itabuna, ca. 14°51′S, 39°20′W, 100 m, 8 Mar. 1972, *C. E. Calderón & R. S. Pinheiro 2159* (CEPEC, K, NY, US), 10 Mar. 1972, *C. E. Calderón & R. S. Pinheiro 2163* (CEPEC, K, MO, US); Itanhém, estrada Itanhém a Batinga, ca. 16 km ramal à direita, dando acesso à Faz. Pedra Grande, de prop. Etevaldo Rezende da Silva, 17°8′17″S, 40°25′34″W, 29 Dec. 2004, *A. M. Amorim, J. G. Jardim, J. L. Paixão V. Faladelfo & S. C. Sant'Anna 4590* (CEPEC, HUEFS); 17°07′57.8″S, 40°25′17.8″W, 260–300 m, 18 Mar. 2001, *W. W. Thomas, J. Jardim, F. Juchum & A. Carvalho 12340* (CEPEC, HUEFS, NY).

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Taxonomic Notes on *Onobrychis* sect. *Hymenobrychis* (Fabaceae, Hedysareae) in Iran

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Abstract. *Onobrychis kuchanensis* Ranjbar, Hajmoradi & Karamian, a singular new species endemic to Iran, is described and illustrated. The new species belongs to *Onobrychis* Miller subgen. *Sisyrosema* (Bunge) Grossheim sect. *Hymenobrychis* DC. *Onobrychis kuchanensis* is distributed in Khorasan Province in northeastern Iran. It is closely related to *O. amoena* Popov & Vvedensky and is distinguished by its corolla neither distinctly striate nor purple maculate and its calyx shorter than 5 mm. The conservation status is evaluated as Vulnerable (VU) according to IUCN Red List criteria. Moreover, *O. amoena* subsp. *meshhedensis* Širjaev & Rechinger is raised to specific rank as *O. meshhedensis* (Širjaev & Rechinger) Ranjbar on the basis of morphological evidence. Relationships between both species and their closest relatives are discussed.

Key words: Fabaceae, Iran, IUCN Red List, *Onobrychis*, sect. *Hymenobrychis*, subg. *Sisyrosema*.

Onobrychis Miller (Fabaceae) comprises about 170 species arranged in 12 sections, mainly occurring in southwestern Asia, the Mediterranean region, and in temperate Europe and Asia (Cronquist, 1981). Some are cultivated as fodder or as ornamentals (Lock & Simpson, 1991; Yakovlev et al., 1996; Mabberley, 1997). In *Flora Iranica*, Rechinger (1984) accepted 54 species in nine sections for Iran: section *Dendrobrychis* DC., section *Lophobrychis* Handel-Mazzetti, section *Onobrychis*, section *Laxiflorae* (Širjaev) Rechinger, section *Anthyllium* Nábělek, section *Afghanicae* Širjaev, section *Heliobrychis* Bunge ex Boissier, section *Hymenobrychis* DC., and section *Insignes* (Širjaev) Rechinger, with two species unassigned. Recently new taxa have been described in *Onobrychis* and *Hedysarum* L., both of the tribe Hedysareae, from Iran (Ranjbar et al., 2004, 2006, 2007a, b, 2010; Ranjbar, 2009). The present paper is focused on a new Iranian taxon from *Onobrychis* sect. *Hymenobrychis*. This section is represented in Iran by 11 species, and is the second largest section in *Onobrychis* subg. *Sisyrosema*.

The species of *Onobrychis* sect. *Hymenobrychis* can be assigned to three different natural groups distinguished from each other mainly in the shape and size of flowers. The *O. michauxii* DC. group, characterized by the corolla distinctly striate and the calyx longer than 5 mm, includes the majority of the species (ca. 6 species) belonging to this section. The species of the *O. amoena* Popov & Vvedensky group are distinguished by the corolla with purple maculae and the calyx not exceeding 5 mm. Finally, the *O. kuchanensis* group consists of the single new species described below, which is characterized by corollas neither distinctly striate nor purple maculate and the calyx shorter than 5 mm.

In order to resolve the morphological heterogeneity of the section and the assignment of doubtful specimens, a detailed morphological study has been conducted by the first author on taxa attributed to this section and other related groups. According to our results, *Onobrychis amoena* subsp. *meshhedensis* Širjaev & Rechinger should be raised to specific rank; this is done below. Moreover, our related field research in Khorasan Province in 2007 led to the discovery of unusual plants of a related taxon occurring together with populations of subspecies *meshhedensis* near Kuchan. Studies of living material and herbarium specimens suggest that the new taxon, which occurs exclusively in the Kuchan submountains, is especially close to *O. amoena*. However, morphological differences support its recognition as a new distinctive species, which we describe here.

1. **Onobrychis kuchanensis** Ranjbar, Hajmoradi & Karamian, sp. nov. TYPE: Iran. Khorasan: Sabzevar to Kuchan, 97 km before Sabzevar, 1492 m, 5 June 2007, *M. Ranjbar & F. Hajmoradi 12899* (holotype, BASU; isotypes, MO, TARI). Figure 1.

Haec species *Onobrychidi amoenae* Popov & Vvedensky affinis sed ab ea foliolis 2- ad 4-jugis (nec 3- ad 7-jugis), stipulis 3–4 mm (nec 8–10 mm) longis, calyce ca. 3 mm (nec 4–5 mm) longo, vexillo neque purpureo-maculato neque purpureo-striato atque alis glabris (nec ciliatis) distinguitur.

Ascending erect to zigzag, glabrous perennial with thick woody rootstock, to 60 cm tall. Stipules thinly free, chartaceous, 3–4 × 1.5–2 mm, triangular,

Figure 1. *Onobrychis kuchanensis* Ranjbar, Hajmoradi & Karamian. —A. Habit with details of flower and pod. —B. Calyx. —C. Standard. —D. Keel. —E. Wings. —F. Androecium. —G. Pistil. —H. Pod. Drawn from the holotype, *M. Ranjbar & F. Hajmoradi 12899* (BASU). Scale bar: A = 2 cm; B–H = 1 cm.

acuminate, glabrous in upper parts or sparsely to loosely villous at the base; leaves 5–15 × 2–3 cm; rachides remote, slender to thickened, straight or curved and ascending, glabrous, petiole 2.6–8 cm; leaflets in 2 to 4 pairs, lanceolate to oblong or elliptic, round to cuneate at base, acute to acuminate at apex, 7–30 × 2–5 mm, acute to obtuse at tip, adaxially glabrous, abaxially glabrous to rarely sparsely appressed to ascending hairy. Inflorescence 6–28 × 2–2.5 cm, narrow, oblong before anthesis, composed of

Table 1. Diagnostic morphological characters of *Onobrychis kuchanensis*, *O. meshhedensis*, and *O. amoena*.

	O. amoena	*O. kuchanensis*	*O. meshhedensis*
Height (cm)	40–50	≤ 60	≤ 80
Stem indumentum	shortly appressed pubescent	glabrous	sparsely to completely glabrous
Stipule length (mm)	8(–10)	3–4	5–8
Leaflet pairs	3 to 7	2 to 4	2 to 4
Leaflet indumentum, abaxial surface	shortly appressed pubescent	glabrous	glabrous
Calyx length (mm)	4–5	ca. 3	7–8
Corolla color	yellow with darker purple venation	yellowish green without darker venation or purple maculae	yellow with red maculae
Standard length (mm)	10–11	9–10	7–8
Wing indumentum	± ciliate	glabrous	± ciliate
Keel length (mm)	10–11	ca. 10	ca. 7
Pod indumentum	± toothed	± toothed	toothed

11 to 23 flowers, elongating in fruit; peduncle 5.5–11(–20) cm; pedicels ca. 1.2 mm, with loosely to densely spreading trichomes 0.1–0.5 mm; bracts papery, brown, 1.3–2 × 0.3–0.5 mm, oblong to lanceolate or triangular, acute to acuminate, glabrous to sparsely pubescent; bracteoles narrowly linear, ca. 0.5 mm. Calyx ca. 3 mm, green, ± densely appressed pubescent, 0.1–0.6 mm, teeth ca. 1.8 mm, linear to triangular; corolla yellowish green, without darker venation, standard 9–10 × 8–9 mm; wings ca. 3 mm, shorter than standard and keel; limb ca. 2 × 1.2 mm, briefly oblong, rounded at tip, claw filiform, ca. 1 mm; keel ca. 10 mm; limb ca. 6 × 5.5 mm; claw ca. 4 mm; stamens 8–9 mm, the free portion ca. 3 mm. Pods with a stipe to ca. 1 mm, semiorbicular, pendent, 5–10 × 3–6 mm, hirsutulous, with trichomes 0.2–1.5 mm, foveolate on disc, with setose crest on margin.

Distribution and habitat. *Onobrychis kuchanensis* appears to be extremely restricted in its geographic distribution. It is currently known only from its type locality on the south slope of Mt. Kopet Dag in Iran. It grows in the dry steppe and stony clay terrain of the submountainous region in and around the village of Kuchan; one small population has been observed.

IUCN Red List category. We observed a very low frequency of the new species in its locality, which consisted of no more than 10 plants sparsely scattered near the village. It is therefore evaluated as Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001) to identify taxa with small populations that could be at risk.

Etymology. The new species is named after the village of Kuchan, in Khorasan Province of northeastern Iran.

Relationships. The isotype material of *Onobrychis amoena* was available at W and the detailed original description and type photo of *O. amoena* were compared (Popov & Vvedensky, 1927). *Onobrychis kuchanensis* is the closest relative to *O. amoena*, which is also found in Khorasan Province in northeastern Iran. The species are similar in having fewer leaves with leaflets of similar shape and size, and similar pods whose shape and structure affine *O. kuchanensis* to *Onobrychis* sect. *Hymenobrychis*. However, *O. kuchanensis* differs mainly by being completely glabrous or glabrescent, by the shape and indumentum of the standard, and by the type of pod indumentum. Important differences between the new species and its related taxa are presented in Table 1.

2. Onobrychis meshhedensis (Širjaev & Rechinger) Ranjbar, comb. et stat. nov. Basionym: *Onobrychis amoena* Popov & Vvedensky subsp. *meshhedensis* Širjaev & Rechinger, Feddes Repert. 48: 45. 1940. TYPE: Iran. Khorasan: "in tractu australi montium inter Robat-e Safid et Torbate- Heydariyeh," 10 July 1937, *K. H. Rechinger 1575* (holotype, W).

Onobrychis meshhedensis is recognized at the species rank for those plants previously treated as *O. amoena* subsp. *meshhedensis*; it is distinguished from *O. amoena* by its glabrous morphology and larger habit. *Onobrychis meshhedensis* is an endemic species known from the submontane regions from 1492 to 2000 m elevation near Mashhad, Sabzevar, Torbate-Heydariyeh village in northeastern Iran. In this region, *O. meshhedensis* forms relatively sparse populations, but it is one of the region's most frequently observed *Onobrychis* species.

Specimens examined. IRAN. **Khorasan:** Chehel-dokhtar, Gor Khod (Gur-chal) Pro. Reg., Dasht Aheh (Ahu?), *M. Moussavi & A. Karavar 33603* (IRAN, W); Robate-Safid inter Mashhad et Torbate-Heydariyeh, *J. Renz & H. Runemark*

55964 (W), *K. H. Rechinger 1536* (W), *Rechinger 4409* (W), *Rechinger 55873* (W); Bardu Forest, *W. N. Koelz 16760* (W); Yoghatay, 20 km N of Sabzevar, *Rechinger 53672* (W); Sabzevar to Esfarayen, Afchang village, *M. Ranjbar & F. Hajmoradi 13632* (BASU); Sabzevar to Esfarayen, *Ranjbar & Hajmoradi 13641* (BASU); Sabzevar to Kuchan, 97 km before Sabzevar, *Ranjbar & Hajmoradi 13642* (BASU); Torbate-Heydariyeh, Moajen valley, *M. Ayatollahi & H. Zangooei 14594* (FUMH), *G. Faghihnia & H. Zangooei 19059* (FUMH); Torbate-Heydariyeh, Yarfazli valley, *Faghihnia & Zangooei 22286* (FUMH).

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New Species of *Tibouchina* (Melastomataceae) from Minas Gerais, Brazil

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Abstract. The new species *Tibouchina melanocalyx* R. Romero, P. J. F. Guimarães & Leoni (Melastomataceae) presents a glabrous hypanthium and calyx lobes, is black in dried material, has glabrous filaments and style, and has an ovary with a furrowed apex with five oblong appendages. These characteristics of the hypanthium and ovary are unique within the genus *Tibouchina* Aublet. This species occurs in highland, campos de altitude vegetation from the National Park of Caparaó and State Park of Serra do Brigadeiro, in Minas Gerais, Brazil.

Resumo. A espécie inédita *Tibouchina melanocalyx* R. Romero, P. J. F. Guimarães & Leoni (Melastomataceae) apresenta hipanto e lacínias do cálice glabras e nigrescentes no material herborizado, filetes e estilete glabros e ovário com ápice fendido com cinco apêndices oblongos. As características do hipanto e do ovário são únicas para o gênero *Tibouchina* Aublet. Esta espécie ocorre em campos de altitude dos Parque Nacional do Caparaó e Parque Estadual da Serra do Brigadeiro, no estado de Minas Gerais, Brazil.

Key words: Brazil, IUCN Red List, Melastomataceae, Minas Gerais, *Tibouchina*.

The National Park of Caparaó, with altitudes from 1000 to 2890 m, is located along the boundary of Minas Gerais and Espírito Santo states in Brazil and presents 10 endemic species of Apocynaceae, Ericaceae, Eriocaulaceae, Orchidaceae, Scrophulariaceae, and Velloziaceae (Leoni & Souza, 1999). The State Park of Serra do Brigadeiro is located in the Zona da Mata, southeast of Minas Gerais. The vegetation of both parks is composed of forests and highlands known as campos de altitude. A new species of *Tibouchina* Aublet was discovered during the systematic treatment of Melastomataceae from the National Park of Caparaó (Faria et al., 2006) and is presented here.

Tibouchina melanocalyx R. Romero, P. J. F. Guimarães & Leoni, sp. nov. TYPE: Brazil. Minas Gerais: Parque Estad. da Serra do Brigadeiro, Fervedouro, 7 July 1995, *L. S. Leoni 2995* (holotype, GFJP; isotypes, HUFU, MO). Figure 1.

Haec species ab omnibus speciebus generis hypanthio oblongo tereti glabro et ovario apice appendicibus oblongis 5 praedito differt.

Shrub, 0.3–1 m tall; stems black, angular, flattened at apex, glabrous or with sparse, strigose trichomes, elongate at the nodes. Petiole 3–15 mm; leaf blade 4–9 × 2–4.5 cm, ovate-oblong, apex acute, margin strigose, base rounded, trichomes strigose, blade adaxially glabrous or with strigose trichomes, abaxially with strigose trichomes under the principal and lateral veins, 5-nerved, prominent veins on the adaxial surface, impressed abaxially. Thyrse terminal, ca. 60 flowers, 20–24 cm; bracteoles 2, 8–15 × 4–9 mm, oblong, flat, both surfaces glabrous, margin ciliate, caducous. Flowers 5-merous, pedicellate, pedicels 3–4 mm; hypanthium 10.5–12 × 4–5 mm, black, oblong, terete, glabrous, calyx persistent, tube ca. 1 mm, calyx lobes 5–5.5 × 2.7–3.3 mm, oblong, apex rounded, frequently retuse or obtuse, margin ciliate, glabrous on both surfaces; petals 13–23 × 10–22 mm, purple, obovate, apex truncate, lightly retuse, glandular-ciliate; stamens 10, isomorphic, unequal size; filaments glabrous, anthers subulate, apex attenuate, ventral inclined pore, ventral biauriculate appendage with 2 apical glands or glabrous, large stamens with

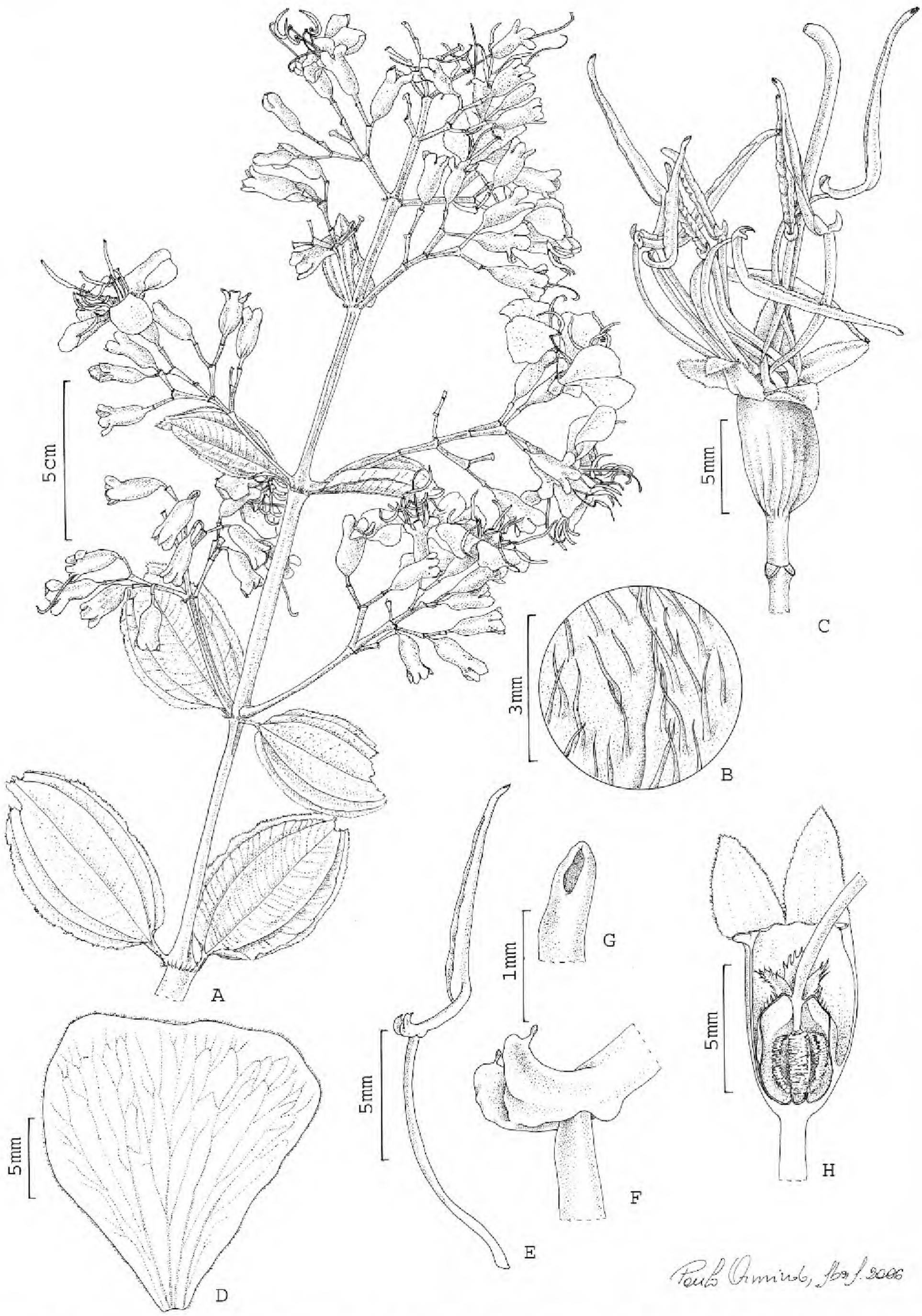

Figure 1. *Tibouchina melanocalyx* R. Romero, P. J. F. Guimarães & Leoni. —A. Habit. —B. Leaf, indument of the abaxial surface. —C. Hypanthium, stamens, and style. —D. Petal. —E. Lateral view of stamen. —F. Detail of the connective. —G. Detail of the anther apex. —H. Longitudinal section of the hypanthium showing the ovary with oblong appendages. Drawn from the paratype *Leoni 1941* (SP).

filaments 10.5–11.5 mm long, thecae 11–12 mm, connective prolonged 3–4 mm below the thecae, small stamens with filaments 8.5–9.5 mm long, thecae 9–10 mm, connective prolonged 1.5–2 mm, ovary ca. 7.5 × 5 mm, 2/3 adnate to the hypanthium, apex strongly furrowed, with 5 oblong appendages, with long strigose-sericeous and short glandular trichomes, caducous glands, 5-locular; style 5.5–7 mm, filiform, curved in the apex, glabrous, stigma punctiform. Fruit not seen.

Distribution, habitat, and IUCN Red List category. *Tibouchina melanocalyx* is endemic to the State Park of Serra do Brigadeiro and the National Park of Caparaó, Minas Gerais, Brazil. This species occurs in highland, campo de altitude vegetation between 1500 and 2200 m, in stony soil with species of Poaceae and Bromeliaceae. At this time, according to IUCN Red List categories and criteria, the conservation status for *T. melanocalyx* is Data Deficient (DD) because the appropriate data on abundance and/or distribution are lacking for the area (IUCN, 2001).

Phenology. This species flowers from May to August.

Etymology. The specific epithet refers to the characteristic dark color of the calyx lobes and hypanthium in dried material.

Discussion. The new species *Tibouchina melanocalyx* presents a glabrous hypanthium and calyx lobes with caducous bracts, is black in dried material, and has glabrous filaments and style. The ovary has a furrowed apex with five oblong appendages, with both long sericeous and short glandular trichomes and caducous glands. The presence of caducous bracts and glabrous filaments is observed frequently among the species of *Tibouchina* sect. *Diothantera* Triana, but the characteristics of the hypanthium and ovary in *T. melanocalyx* are unique to the genus. The foliar morphology, considering the texture, indument, and veins, suggests that this species is more closely related to *T. virgata* (Gardner) Cogniaux, known only from Serra dos Órgãos, Rio de Janeiro, Brazil (Guimarães, 1997). *Tibouchina virgata* belongs to section *Pleroma* D. Don, but it should be emphasized that the sectional limits in *Tibouchina* are tenuous because most sections reflect previously recognized genera and are not monophyletic clades based on morphological characters (Romero & Guimarães, 2005).

Paratypes. BRAZIL. **Minas Gerais:** Parque Nac. do Caparaó, Vale Encantado, 14 June 1991, *G. Hatschbach, M. Hatschbach & J. M. Silva 55491* (C, MBM); Serra da Grama, Pedra do Pato, 20°44′S, 42°28′W, 17 Aug. 1992, *L. S. Leoni 1941* (SP); Alto Caparaó, Parque Nac. do Caparaó, Vale Encantado, 29 May 1999, *W. Foster & L. S. Leoni 84* (ESA); córrego José Pedro, 29 May 1999, *L. S. Leoni & W. Forster 4190* (GFJP); Vale Encantado, campo de altitude, May 2004, *L. S. Leoni & V. A. Tinte 5726* (GFJP).

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Opuntia chiangiana, Una Nueva Especie de Cactaceae de Oaxaca, México

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Resumen. Se describe una nueva especie de *Opuntia* (L.) Miller (Cactaceae), endémica de la región de Cuicatlán, estado de Oaxaca, México. Frutos rojo-violáceos con espinas largas, funículos semi-secos de paredes comestibles que no se desprenden de los cladodios cuando maduran, no son comidos por pájaros debido a su sabor agridulce (conocidos como xoconostles o xoco-tunas). Se compara con tres especies simpátricas descritas con anterioridad: *O. tehuacana* S. Arias & U. Guzmán, *O. parviclada* S. Arias & Gama y *O. olmeca* Joel Pérez, J. Reyes & F. Brachet. *Opuntia chiangiana* Scheinvar & Manzanero es ubicada en la serie Heliabravoanae Scheinvar con base en sus frutos ácidos.

Abstract. A new species of *Opuntia* (L.) Miller (Cactaceae), endemic to the region of Cuicatlán in the state of Oaxaca, Mexico, is described. The fruits are red-violet with long spines, funiculi that are almost dry, and fruit walls that are edible and do not fall off when mature. However, birds have not been observed to eat the fruits of this sweet-acidic cactus pear (known as xoconostle or xoco-tuna). The new species is compared to three sympatric species formerly described: *O. tehuacana* S. Arias & U. Guzmán, *O. parviclada* S. Arias & Gama, and *O. olmeca* Joel Pérez, J. Reyes & F. Brachet. *Opuntia chiangiana* Scheinvar & Manzanero is assigned to series Heliabravoanae Scheinvar on the basis of its acidic fruits.

Key words: Cactaceae, IUCN Red List, Mexico, Oaxaca, *Opuntia*.

"Especies Silvestres de Nopales Mexicanos" elaborada por Scheinvar et al. (inédito) cita 106 especies silvestres en todo el país; 22 en Oaxaca, lo que corresponde a 20.7% del total, distribuidas principalmente en la franja central del estado, en bosque tropical caducifolio mediano y en bosque de encino. *Opuntia decumbens* Salm-Dyck y *O. puberula* Pfeiffer amplían su distribución hacia la costa en el bosque tropical caducifolio bajo. Cinco especies son endémicas y de distribución restringida en Oaxaca: *O. huajuapensis* Bravo, *O. nejapensis* Bravo, *O. olmeca* Joel Pérez, J. Reyes & F. Brachet, *O. parviclada* S. Arias & Gama y *O. tehuacana* S. Arias & U. Guzmán, todas representadas en la Reserva de la Biosfera de Tehuacán-Cuicatlán, que alberga un total de 15 especies diferentes de *Opuntia*. Parte del área de distribución de estas especies se encuentra ocupada por zonas agrícolas y por lo tanto son vulnerables debido a las actividades humanas que significan pérdida de hábitats naturales.

Opuntia chiangiana Scheinvar & Manzanero, sp. nov. TIPO: México. Oaxaca: Distr. Cuicatlán, a 5 km de Santiago Quiotepec, rumbo a San Juan Coyula, 170°54′10″N, 96°58′W, 800 m, 5 mayo 2006, *G. Manzanero GM370* (holotipo, MEXU; isotipos, MO, OAX). Figuras 1–4.

Haec species quoad fructus exocarpium maturitate non separatum etiam funiculos siccos subsiccosve ad species oaxacenses *Opuntiam olmeca* Joel Pérez, J. Reyes & F. Brachet, *O. parvicladam* S. Arias & Gama et *O. tehuacanam* S. Arias & U. Guzmán maxime accedit, sed ab eis habitu reptante, cladodiis ellipticis basi angustatis terminalibus 36–37 cm longis, cladodiorum areolis in series 13 dispositis ac spinis albis apice translucidis, floris percarpello spinis duabus acicularibus ad areolas superiores tantum armato, stylo rubroviolaceo atque fructu pyriformi dulci-acido distinguitur.

Planta rastrera, hasta 2.5 m de altura; copa extendida, hasta de 2.5 m de diám. (Figs. 1A, 2A); raíces fibrosas emergen de una parte subterránea globosa; tronco rastrero, de 15–20 cm hasta la primera ramificación, 12–15 cm diám.; corteza escamosa, de color gris-oscuro, con 7 espinas divergentes, hasta 2.7 cm, en todas las aréolas. Cladodios ascendentes, los adultos elípticos, de base angostada,

Figura 1. *Opuntia chiangiana* Scheinvar & Manzanero. —A. Hábito de la planta rastrera, con frutos rojo-violáceos, provistos de largas espinas (foto de Miriam Mena Mendieta). —B. Cladodio con espinas en todas las aréolas y frutos con espinas largas en las aréolas superiores (foto de Gabriel Olalde Parra).

encorvada, bordes ligeramente cóncavos, ca. 30–37 × 15–17 cm, y ca. 1.5 cm de espesor (Figs. 1B, 2B); epidermis glabra, estomas paracíticos, poco hundidos; células epidérmicas isodiamétricas, paredes anticlinales sinuosas (Fig. 3F), verde-oliva oscuro, recubierto de cera grisácea; cladodios juveniles verde-claros; aréolas con hojas de 5–7 mm, porrectas, subuladas, de color verde-claro con el ápice rosado; cladodios adultos con aréolas elípticas, elevadas, dispuestas en 11–13 series (Fig. 2B), distantes ca. 3 cm entre sí, de ca. 3.2 × 1.6 mm, con lana marrón; gloquidios caducos, dispuestos cerca del borde de la aréola, amarillos, con púas adpresas e imbricadas, ápice ligeramente elevado, ca. 4 mm (Figs. 3A, B). Espinas 1 a 3 (Figs. 1B, 2A), dispuestas en todas las aréolas del cladodio, divergentes, extendidas, cuando una, doblada en la base, algo refleja, algunas torcidas, subuladas, de 1.5–2.7 cm, las más largas en los bordes del cladodio, blancas con el ápice translúcido, en la base con púas angostas y oblongas, adpresas (Fig. 3C); parte mediana con células paralelas entre sí, recubiertas de cera granulosa, con espacios intercelulares bien marcados (Figs. 3D, E). Flores amarillas, de 5.7–6 × ca. 4 cm en la antesis; pericarpelo verde, de ca. 2.5 × 3 cm, reticulado, podarios elevados, tetragonales; aréolas dispuestas en 5 series; espinas 2, blancas, aciculares, de ca. 0.5 cm, sólo en las aréolas superiores (Fig. 2C); androceo amarillo, la base de los estambres verdosa; estilo blanco-rosado, emergente sobre los estambres, lóbulos

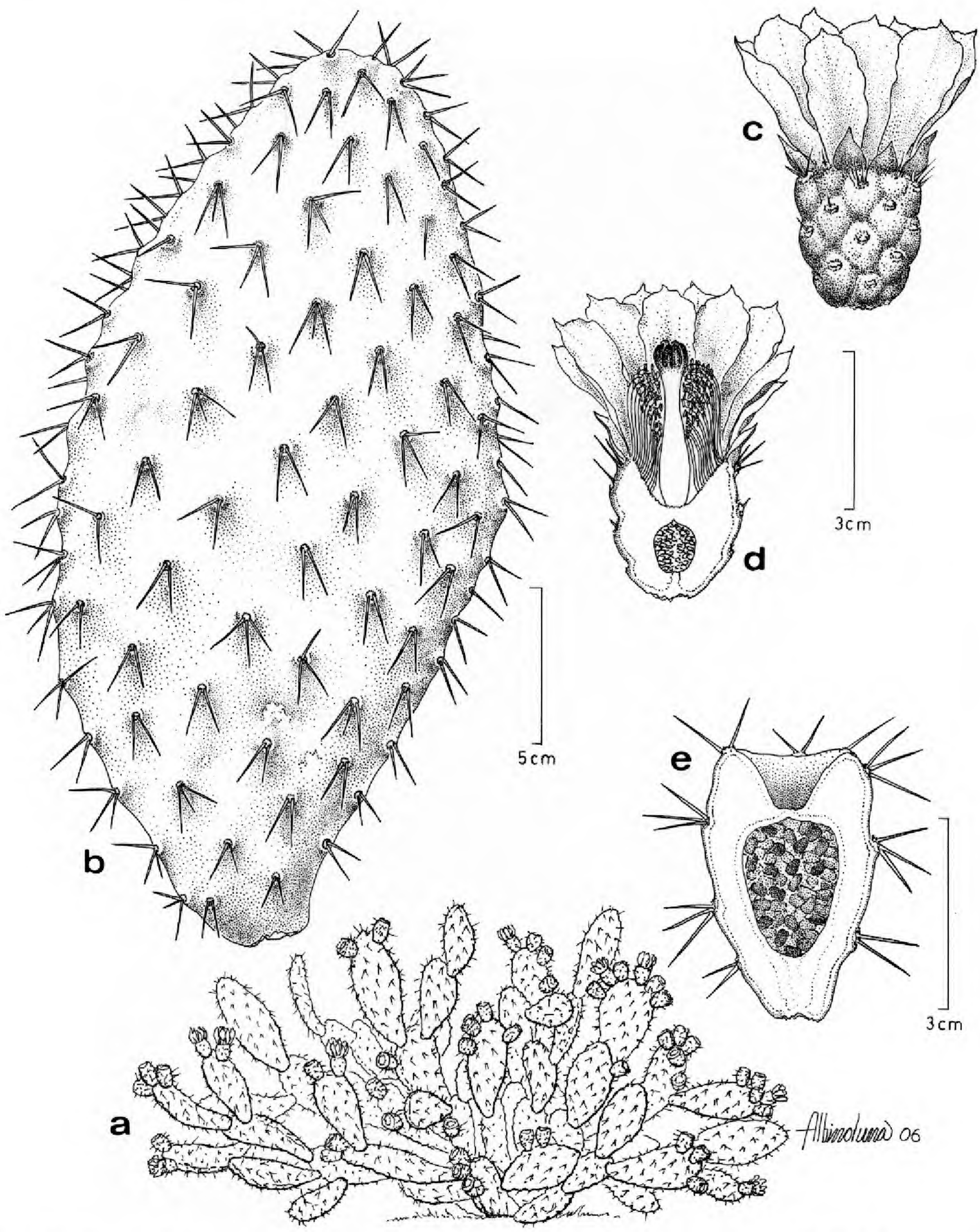

Figura 2. *Opuntia chiangiana* Scheinvar & Manzanero. —A. Hábito rastrero, con flores y frutos. —B. Cladodio con espinas en todas las aréolas y 11 series de aréolas. —C. Vista exterior de una flor. —D. Corte longitudinal de una flor, vista interior. —E. Corte longitudinal de un fruto, vista interior, paredes anchas, comestibles, funículos semi-secos. (Ilustración de Albino Luna Sánchez, Instituto de Biología, UNAM.)

del estigma 6 (Fig. 2D), blanco-verdosos; granos de polen periporados, 19 poros, poliédricos, 80–88 μm diám., tectum reticulado, muros sin espínulas o verrugas (Fig. 4A). Frutos piriformes, rojo-violáceos, de 3.5–4 × ca. 2 cm en la parte superior; cicatriz floral hundida, de ca. 0.8 cm de profundidad; aréolas dispuestas en 5 series con 1 a 3 espinas rígidas, punzantes, aciculares, hasta de 1.6 cm de largo, blancas con el ápice púrpura, en casi todas las aréolas; paredes del fruto hasta de 1 cm de ancho (Fig. 2E), rojizas; funículos semi-secos, agridulces; semillas discoidales (Fig. 4B), de ca. 3 × 2.9 mm;

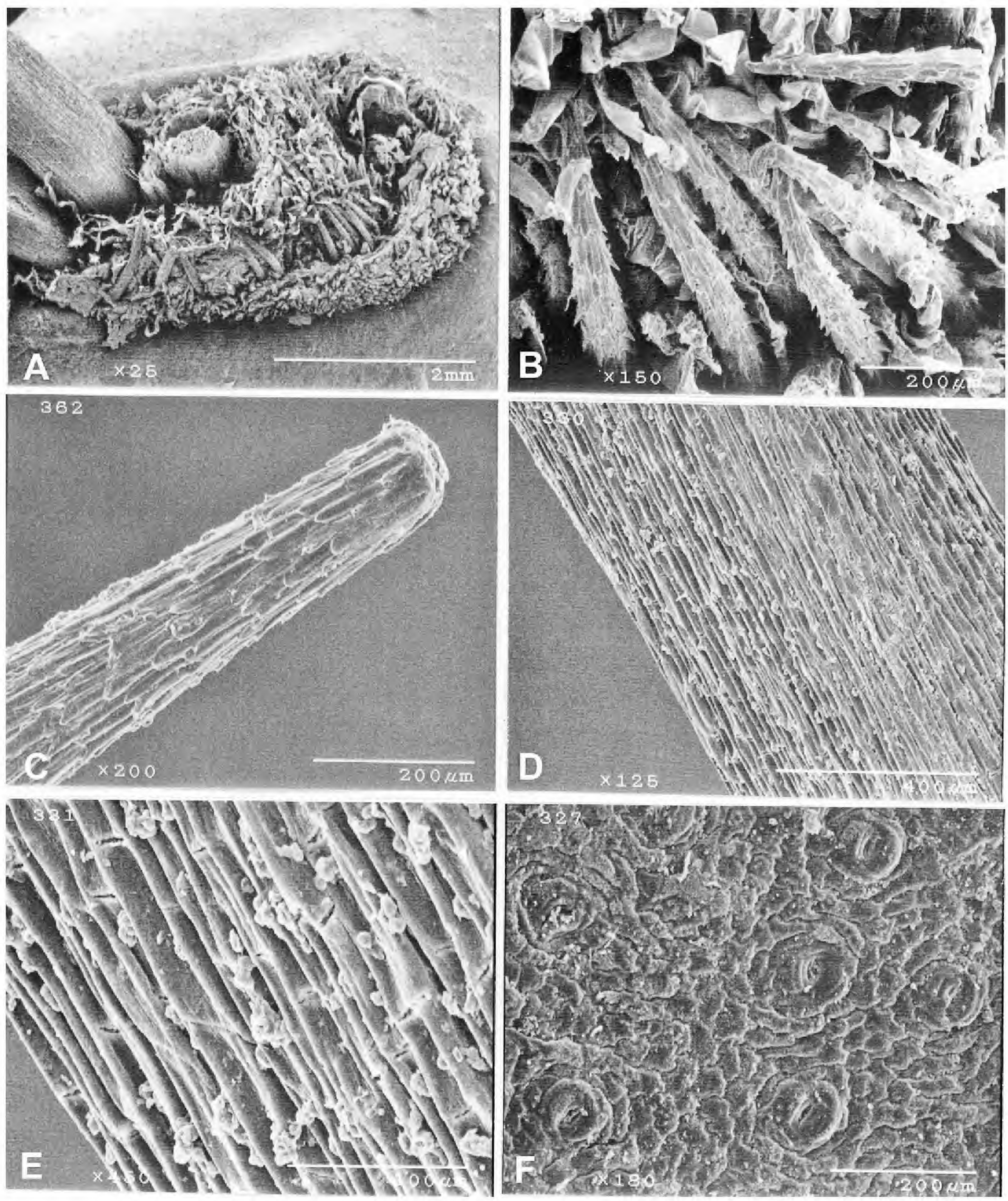

Figura 3. *Opuntia chiangiana* Scheinvar & Manzanero. —A. Aréola con lana, gloquidios en sus bordes y base de dos espinas. —B. Gloquidios con barbas imbricadas, adpresas pero algo elevadas en sus ápices. —C. Ápice de una espina con barbas largas, angostas, imbricadas, ápices ligeramente elevados (×200). —D. Parte mediana de una espina con células paralelas entre sí, con espacios intercelulares. —E. Parte mediana con mayor aumento. —F. Epidermis con estomas paracíticos y células epidérmicas anticlinales isodiamétricas a alargadas, ligeramente onduladas. (Fotos de Berenith Mendoza Garfia, Instituto de Biología, UNAM.)

arilo lateral ancho, región hilo-micropilar lateral, profunda, micrópilo y funículo inclusos (Fig. 4C).

Distribución y hábitat. Se trata de una especie del valle de Tehuacán-Cuicatlán, región de Cuicatlán, que fue encontrada por primera vez y colectada por Jerónimo Reyes, entre en la región de Quiotepec, Pico del Águila hasta y Soyula, cerca de Cuicatlán, donde observó como mil plantas de esta especie (com. pers.) y cultivada en el Jardín Botánico Regional "Cassiano Conzatti" del Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional del Instituto

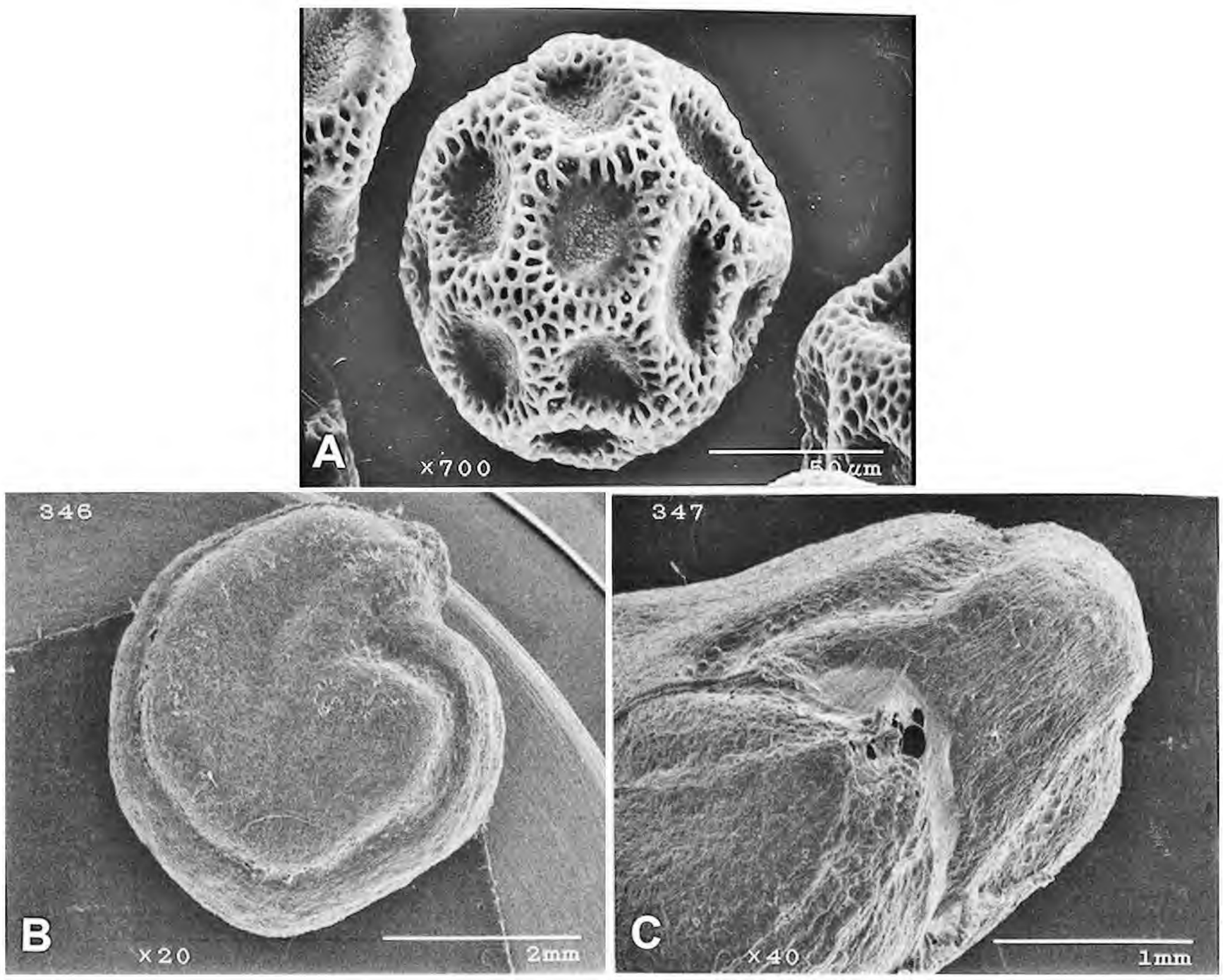

Figura 4. *Opuntia chiangiana* Scheinvar & Manzanero. —A. Grano de polen. —B. Semilla. —C. Parte de la región hilo-micropilar. (Fotos de Berenith Mendoza Garfia, Instituto de Biología, UNAM.)

Politécnico Nacional, Unidad Oaxaca (CIIDIR, OAX), Reg. No. JBCC 125 (*J. Reyes 2969*), y en el Jardín Botánico del Instituto de Biología de la UNAM. La segunda autora la encontró en otra localidad de la misma área, donde sólo observó tres plantas, cuyo material sirvió para elaborar los ejemplares tipo.

De la misma zona fueron descritas tres especies de *Opuntia* de distribución restringida, productoras de xoconostles: *O. parviclada* y *O. tehuacana* (Arias et al., 1997) y *O. olmeca* (Pérez et al., 2005), cuyas características se comparan con la simpátrica nueva especie en el Cuadro 1.

Tipo de vegetación y especies asociadas. *Opuntia chiangiana* es conocida de bosque tropical caducifolio, sensu Rzedowski (1978), asociada a las especies: *Escontria chiotilla* (F. A. C. Weber) Rose, *Pachycereus weberi* (J. M. Coulter) Backeberg, *Bursera* Jacquin, *Plumeria rubra* L., *Acacia* Miller, *Senna* Miller, *Agave* L., *Hechtia* Klotzsch, *O. olmeca*, *O. parviclada* y *O. tehuacana*.

Las paredes de los frutos y los funículos semi-secos, de sabor agridulce, nunca comidos por los pájaros, indican que se trata de una forma intermedia entre tuna y xoconostle, denominados por los campesinos como xoco-tunas. Cuando maduran, quedan adheridos a los cladodios hasta más de un año, así como ocurre con los xoconostles.

Opuntia chiangiana por poseer xoco-tunas, pudiera ser un híbrido entre una especie productora de tunas y otra de xoconostles, produciendo xoco-tunas. No hay suficientes estudios sobre sus probables progenitores, por lo que optamos describir este nuevo taxón dándole un nombre específico, ya que la hibridación también es un camino de especiación.

Estatus de conservación. Puede ser considerada según la IUCN Red List of Threatened Species (IUCN, 2001) como Vulnerable (VU) con alto riesgo de extinción y de distribución restringida (hasta donde se conoce), por los cambios climáticos y distintas actividades humanas, principalmente agrícolas en el área.

Serie a la cual pertenece. Con relación a la serie a la cual pertenece, pudiera ser la serie *Leucotrichae* Britton & Rose que incluye solamente *Opuntia leucotricha* DC., con epidermis tomentosa, productora de frutos ácidos (xoconostles). Esta serie fue descrita con las siguientes características: "espinas como pelos o cerdas largas, flexibles, en muchos de sus cladodios, especialmente del tallo y cladodios muy viejos. El fruto es muy diferente de las series relacionadas, con pulpa fragrante y cuando madura, la cáscara no se desprende" (Britton & Rose, 1919: 174).

Bravo-Hollis (1978: 312) sigue el mismo criterio de Britton y Rose, pero en la descripción de la serie escribe: "arborescentes, artículos pubescentes, con

Cuadro 1. Características comparativas de cuatro especies de *Opuntia* productoras de xoconostles o xoco-tunas, de la misma región de Oaxaca.

	O. chiangiana	*O. olmeca*	*O. parviclada*	*O. tehuacana*
Hábito	rastrero	arbustivo, hasta 1 m alto; cladodios ascendentes hasta 14 cm de largo	arbustivo, hasta 50 cm alto	subarbustivo, ligeramente postrado o ascendente, hasta 80 cm alto
Epidermis	glabra	glabra	densa o escasamente pubescente	glabra
Forma de cladodios adultos	elípticos, base angostada	anchamente obovados, los juveniles deltoides	oblongos	subcirculares a anchamente obovados
Largo de los cladodios terminales	30–37 cm	ca. 14 cm	5–10 cm	20–29 cm
Número de series de aréolas en cladodios	11–13	7	7	8
Color de las espinas en cladodios maduros	blancas, con el ápice translúcido	amarillo pálido a grisáceas	pardo oscuro	amarillo claras a blanco-grisáceas, grises con la edad
Color y largo de las flores	amarillas, 5.7–6 cm	amarillas, 5.7–6.5 cm	amarillas con franja media roja, 2.5–3.4 cm	rojo-anaranjadas, 3–4.2 cm
Pericarpelo				
Color y indumento	verde, glabro	verde, glabro	verde, pubescente	verde-amarillento, glabro
Dimensiones	ca. 2.5 × 3 cm	3.2–4.2 × 5.6–5.9 cm	1.5–1.8 × 1.3–1.5 cm	4.5–5 × 2.8–3.8 cm
Podarios	elevados	ausentes	evidentes	evidentes
Presencia de escamas basales	aréolas sin escamas basales	aréolas sin escamas basales	aréolas sin escamas basales	aréolas superiores con escamas basales deltoides
Espinas	rígidas, 2, punzantes, aciculares, de ca. 0.5 cm, en aréolas superiores	setosas, > 10	ausentes	ausentes
Filamentos	amarillos con la base verdosa	amarillos	rojo-purpúreos	amarillo-verdosos
Color de estilo	blanco-rosado	blanco	verde claro	verde-amarillento
Fruto				
Color	rojo-violáceo	amarillo	rojo claro	verde-amarillento con manchas purpúreas
Dimensiones	3.5–4 × ca. 2 cm de diám.	4.9–5 cm de diám.	1.8–2.5 × 1.2–1.7 cm de diám.	4.5–5 × 2.8–3 cm de diám.
Forma	piriforme	globoso	obovoide	subgloboso
Tipo	agridulce (xoco-tuna)	ácido (xoconostle)	ácido (xoconostle)	ácido (xoconostle)
Color de las paredes	rojizas	amarillas	rojas	verde-amarillentas
Funículos (suculencia)	semi-secos	algo jugosos	—	algo jugosos
Cicatriz floral	hundida	plana a ligeramente hundida	hundida	ligeramente hundida
Espesor de las paredes del fruto	hasta 1 cm	ca. 1 cm	ca. 0.5 cm	ca. 1.2 cm
Semillas	discoidales, ca. 3 mm de diám.	discoidales, ca. 4 mm de diám.	oblongas, 3–4 × 1.7–2.3 mm	obovada, 3–5 × 1.5–2 mm

aréolas pequeñas y próximas, provistas de abundantes espinas setosas, blancas, especialmente en el tallo. Fruto globoso, blanco-amarillento, con tinte purpúreo y con olor suave y agradable".

Scheinvar (1974: 85), al describir *Opuntia heliabravoana* como rastrera y productora de frutos ácidos (xoconostles), crea una nueva serie Heliabravoanae Scheinvar, con las siguientes características: "plantas cespitosas, extendidas, generalmente hasta 1.30 m de altura. Artículos de 21–50 cm de largo, de color verde-limón algo amarillentos, cubiertos de una capa de cera, glabros, con abundantes gloquidios amarillos. Flores amarillo-verdosas. Frutos carnosos, amarillo-verdosos con manchas color salmón cuando están bien maduros; comestibles, agrios. Semillas hasta 3 mm de diámetro, casi globosas, anguladas, de color gris".

Opuntia chiangiana, *O. olmeca*, *O. parviclada* y *O. tehuacana* comparten las siguientes características en común: frutos ácidos o agridulces, no comidos por pájaros, la cáscara no se desprende cuando el fruto madura, y funículos secos a semi-secos, por lo que se propone ubicarlos en una misma serie (Cuadro 1).

Probablemente hay otras especies mexicanas que producen xoconostles y quizá podrían ser incluidas en una misma serie, en el caso de que estudios de cladística y de biología molecular indiquen que estas especies son monofiléticas.

Etimología. El nombre de esta especie es un homenaje al ilustre y dedicado botánico Fernando Chiang, investigador del Instituto de Biología de la Universidad Nacional Autónoma de México, quien siempre nos ha apoyado en la traducción al latín de las descripciones originales de nuevos taxones.

Paratipos. MÉXICO. **Oaxaca:** Mixteca Oaxaqueña, Valle de Tehuacán-Cuicatlán, entre Quiotepec y Coyula, Mun. Cuicatlán, entre Cuicatlán y Etla, 16 sep. 2000, *L. Scheinvar 6613* (CIIDIR, MEXU, MO); entre Quiotepec y Soyula, valle de Tehuacán-Cuicatlán, cerca de Cuicatlán, y cultivada en el Jardín Botánico Regional "Casiano Conzatti", CIIDIR, Oaxaca, Reg. N°. JBCC 125, *J. Reyes 2969* (MEXU, OAX).

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Two New Brazilian Species of *Phyllanthus* (Phyllanthaceae)

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Abstract. Two new Brazilian species of *Phyllanthus* L. are described and illustrated and their morphological affinities are discussed. *Phyllanthus longipedicellatus* M. J. Silva resembles *P. augustinii* Baill. but differs by its leaves oblong-falcate to falcate-asymmetrical with margins obscurely serrulate, and pistillate flowers with patelliform disk. *Phyllanthus salesiae* M. J. Silva is similar to *P. rosmarinifolius* Müller Argoviensis but it differs from the latter by its lacerate stipules, deeply lobed pistillate disk, incurved and bifid style, and seeds with darkish punctations. Both species are endemic to Brazil and known only from a single locality. The systematic position of both species with regard to the sections and subsections of *Phyllanthus* is also discussed.

Resumo. Duas novas espécies de *Phyllanthus* L. do Brasil são descritas e ilustradas com suas afinidades morfológicas discutidas. *Phyllanthus longipedicellatus* M. J. Silva assemelha-se a *P. augustinii* Baill., mas difere desta pelos folhas oblongo-falcadas a falcado-assimétricas com margens discretamente serruladas e flores pistiladas com disco pateliforme. *Phyllanthus salesiae* M. J. Silva assemelha-se a *P. rosmarinifolius* Müller Argoviensis do qual difere pelas estípulas laceradas, disco pistilado profundamente lobado, estiletes encurvados e bífidos e sementes com pontuações enegrecidas. Ambas as espécies são endêmicas para o Brasil, conhecidas de suas respectivas coleções-tipo e têm suas posições sistemáticas discutidas em relação a seções e subseções de *Phyllanthus*.

Key words: Brazil, IUCN Red List, Phyllanthaceae, *Phyllanthus*.

Phyllanthus L. is a heterogeneous genus in the Phyllanthaceae represented by about 1236 species widely distributed throughout the world (Kathriarachchi et al., 2006). In Brazil, approximately 107 species are found in all vegetation types, especially in rocky fields, caatinga, and cerrado (Silva & Sales, 2007). The taxonomy and identification of the Brazilian species of *Phyllanthus* are problematic because of the tremendous diversity found in the genus and the overall similarity in habit and floral aspects.

As part of a synopsis of the genus *Phyllanthus* for Brazil (Silva, in prep.), collections originating from Bahia and Minas Gerais states were studied, and their morphological characteristics distinguish them as new species, which are described, discussed, and illustrated here.

1. **Phyllanthus longipedicellatus** M. J. Silva, sp. nov. TYPE: Brazil. Bahia: Ituberá, área da Michelin, Vila 05, 13°43′S, 39°08′W, 24 Sep. 2006 (fl.), *R. Valadão de M., J. S. Santos & M. L. Guedes 57* (holotype, ALCB). Figure 1.

Haec species inter species brasilienses *Phyllantho* subsect. *Niruri* quoad ramulos papillosos etiam pedicellos longiores *Phyllantho augustinii* Baill. simillima, sed ab eo lamina foliari minore oblongo-falcata vel asymmetrice falcata atque disco pistillato patelliformi distinguitur.

Monopodial, shrublet ca. 30 cm high; stems erect, terete, papillose in the young parts with blackish trichomes; branching phyllanthoid; cataphylls and cataphyllary stipules 0.8–1 × 0.5–0.7 mm, triangular, not auriculate, escariose, glabrous, margins hyaline; plagiotropic branchlets 6–14 cm with 30 to 57 leaves, axis ca. 0.2 mm wide, slightly flattened and with dark papillae; stipules 1–1.1 mm, lanceolate, acuminate, escarious, glabrous on both surfaces. Leaves subsessile, petiole < 1 mm, leaf blades 5–6 × 2.9–3.9 mm, oblong-falcate to falcate-asymmetrical, obtuse-mucronulate, oblique at base, margins obscurely serrulate, membranaceous, adaxial surface dark green, abaxial surface light grayish green, dull, glabrous; venation brochidodromous, midvein slightly prominent abaxially, secondary veins impressed abaxially. Staminate flowers 2 or 3 in cymules at proximal axils, pistillate flowers solitary at distal axils. Staminate pedicel 9–9.2 mm, capillary, finely papillose; sepals 5, 2.1–2.2 × 1.4–1.5 mm, obovate, rounded, membranaceous, 1-nerved; disk segments 5, alternisepalous, obtriangulate and finely papillose; stamens 3, filaments free, 2.4–2.5 mm, anthers ca. 0.2 mm, connective not enlarged, thecae not deeply emarginate, dehiscing horizontally. Pistillate pedicel 10–10.2 mm, capillary, finely papillose; sepals 5, 2.9–3 × 2–2.1 mm, widely elliptic, acute, membra-

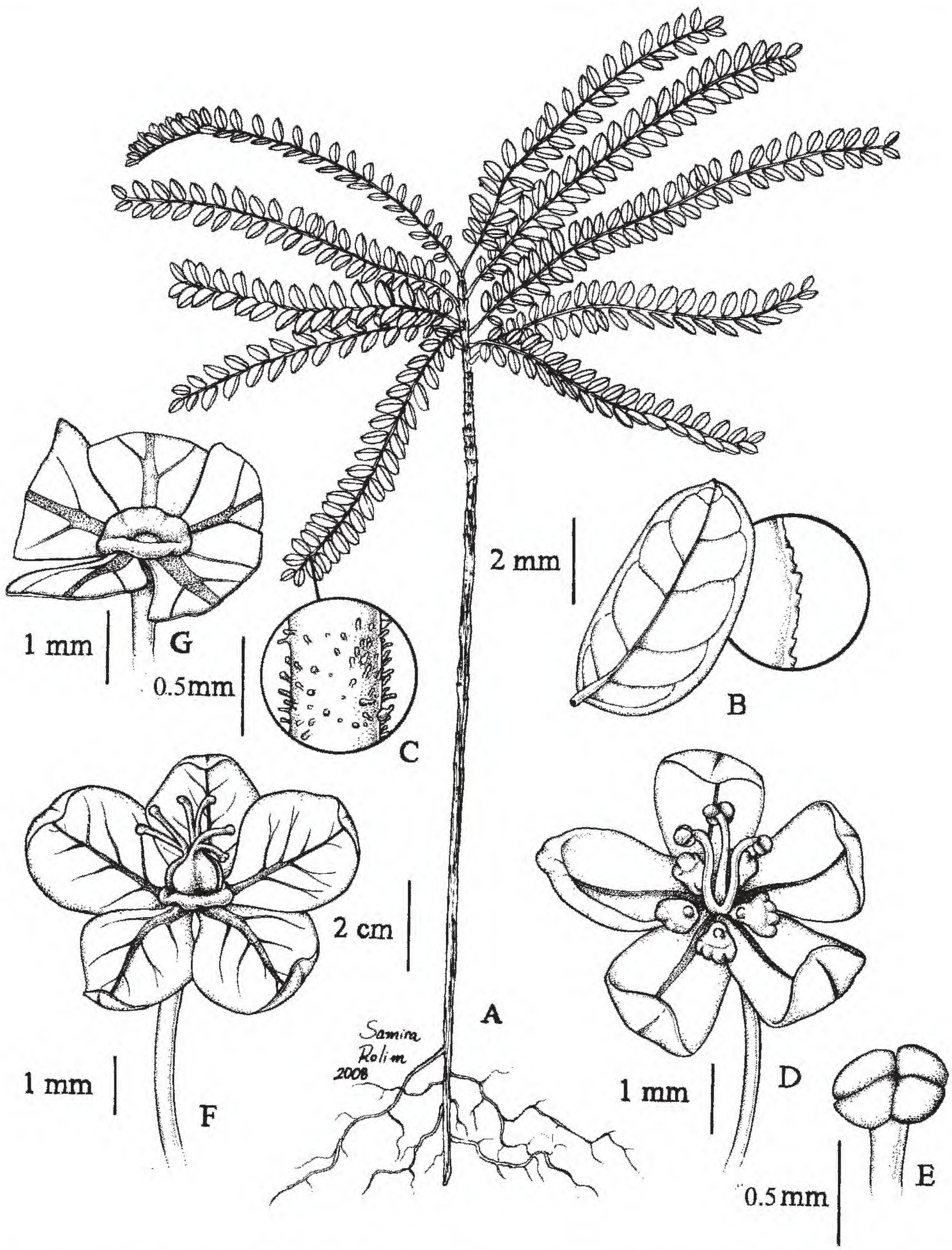

Figure 1. *Phyllanthus longipedicellatus* M. J. Silva. —A. Habit. —B. Leaf, showing the serrulate margins and inequilateral base. —C. Detail of the branch. —D. Staminate flower. —E. Detail of stamen. —F. Pistillate flower. —G. Patelliform disk of the pistillate flower. Drawn from the type, *R. Valadão de M., J. S. Santos & M. L. Guedes 57* (ALCB).

naceous, venation pinnate; disk patelliform, margins finely undulate; ovary 0.8–0.9 × 0.9–0.91 mm, style branches 1.2–1.3 mm, free, bipartite, tips obtuse. Fruits and seeds unknown.

Distribution and habitat. *Phyllanthus longipedicellatus* is known only from the type collection, from southern Bahia State in Brazil. It grows in the coastal rainforest (Mata Atlântica) in shaded,

humid areas on clay soils covered by leaf litter.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the conservation status of *Phyllanthus longipedicellatus* must be considered Data Deficient (DD) because it is known only from the type specimen.

Phenology. *Phyllanthus longipedicellatus* has been collected in flower in September.

Etymology. The specific epithet refers to the long floral pedicels, which are distinctive for the species.

Relationships. The new species, *Phyllanthus longipedicellatus*, can be assigned to *Phyllanthus* sect. *Phyllanthus* subsect. *Niruri* (Webster, 2002a) by its phyllanthoid branching; the leaf blades oblique at the base; and the flowers in unisexual cymules with five sepals, three free stamens horizontally dehiscing, and a segmented disk. Among the other Brazilian species (*P. augustinii* Baillon, *P. niruri*, *P. rosellus* (Müller Argoviensis) Müller Argoviensis, *P. perpusillus* Baillon) of *Phyllanthus* sect. *Phyllanthus* subsect. *Niruri*, only *P. longipedicellatus* resembles *P. augustinii*. Despite the resemblance, *P. longipedicellatus* differs from *P. augustinii* in its leaf blades, with 5–6 × 2.9–3.9 mm, oblong-falcate to falcate-assymetrical, obscurely serrulate margins, pistillate sepals widely elliptic, acute at apex, disk pistillate patelliform with finely undulate margins, and stigma obtuse. In contrast, *Phyllanthus augustinii* possesses leaf blades, 1.9–5.5 × 1–2.9 cm, elliptical to elliptic-obovate, margin foliar entire, pistillate sepals obovate to widely obtrulate, rounded at apex, disk pistillate cupuliform with margins lobed, and stigma capitate.

KEY TO BRAZILIAN SPECIES OF *PHYLLANTHUS* SECT. *PHYLLANTHUS* SUBSECT. *NIRURI*

1a. Plants with branches papillose; pedicels of flowers of both sexes 0.9–3 cm; stamens 3, free.
  2a. Leaf blades 1.9–5.5 × 1–2.9 cm, elliptical to elliptic-obovate; pistillate disk cupuliform . . . . . *P. augustinii*
  2b. Leaf blades 5–6 × 2.9–3.9 mm, oblong-falcate to falcate-asymmetrical; pistillate disk patelliform . . . . . *P. longipedicellatus*
1b. Plants with branches glabrous; pedicels of flowers of both sexes 1.8–3.9 mm; stamens 3, free to completely connate in column.
  3a. Stamens free to partially connate; seeds > 1.5 mm . . . . . *P. niruri*
  3b. Stamens completely connate; seeds < 1.5 mm.
    4a. Plants to 6 cm tall; staminate sepals 0.5–1 mm; seeds 0.85–0.9 mm . . . *P. perpusillus*
    4b. Plants 17–40 cm tall; staminate sepals 1.2–1.6 mm; seeds 1.2–1.3 mm . . . . . *P. rosellus*

2. Phyllanthus salesiae M. J. Silva, sp. nov. TYPE: Brazil. Minas Gerais: Passa Quatro, Pico do Itaguaré, Sertão dos Martins, 22°27′52.2″S, 45°04′33.7″W, 1525 m, 2 Oct. 2005 (fl., fr.), *L. D. Meireles 2064* (holotype, UEC; isotypes, MO, NY, RB, SP). Figure 2.

Haec species a *Phyllantho rosmarinifolio* Müller Argoviensis foliis distichis marginibus serrulatis et pappilosis, stipulis laceratis et disco pistillato dissecto differt.

Shrublet ca. 30 cm high, dioecious; stems erect, sparsely to densely ramified, papillose; branching nonphyllanthoid with lateral branches, persistent and distichous; branchlets terete to slightly flattened, papillose; cataphylls and cataphyllary stipules lacking; stipules 2–2.1 mm, triangular, acuminate, auriculate at base, lacerate margins, escarious, glabrous on both faces, reddish; petioles 1.9–2 mm, cylindrical, greenish, papillose; leaf blades 1.9–4.3 × 0.9–1.9 cm, elliptic, acute, obtuse at base, margins minutely papillose, membranaceous, adaxial surface dark green, abaxial surface opaque, grayish green with papillae concentrated around the midvein; venation brochidodromous, midvein slightly prominent and secondary veins impressed abaxially. Pistillate cymules with 1 or 2 flowers, bracteoles ca. 1 mm, triangular, acuminate, margins slightly serrulate; pedicels 1.7–1.8 mm, terete, visibly articulate; sepals 5, 1.1–1.2 mm, widely elliptic to obovate, acute to obtuse, pinnate venation with whitish margins; disk deeply 5-segmented, margins slightly undulate; ovary 0.4–0.5 × 0.5–0.6 mm, depressed ovate, smooth, styles 3, incurved, bifid, stigma subcapitate. Capsule 2–2.1 × 3.1–3.2 mm, depressed globose, light brown when dry, glabrous, dehiscing loculicidally and septifragally; calyx and style persistent in fruit; seeds 1.8–1.9 × 1.1–1.2 mm, trigonous, brownish, longitudinally finely dark punctate.

Distribution and habitat. *Phyllanthus salesiae* is known only from araucaria forest in Minas Gerais State, Brazil, growing at an altitude of 1525 m at Pico do Itaguaré, with riparian vegetation in clay soils.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the conservation status of *Phyllanthus salesiae* must be considered Data Deficient (DD) because it is known only from the type specimen.

Phenology. *Phyllanthus salesiae* has been collected in flower and fruit in October.

Etymology. The specific epithet honors Margareth Ferreira de Sales, a Brazilian botanist at Universidade Federal Rural de Pernambuco, who introduced me to the science of plant taxonomy and to the beautiful world of the genus *Phyllanthus*.

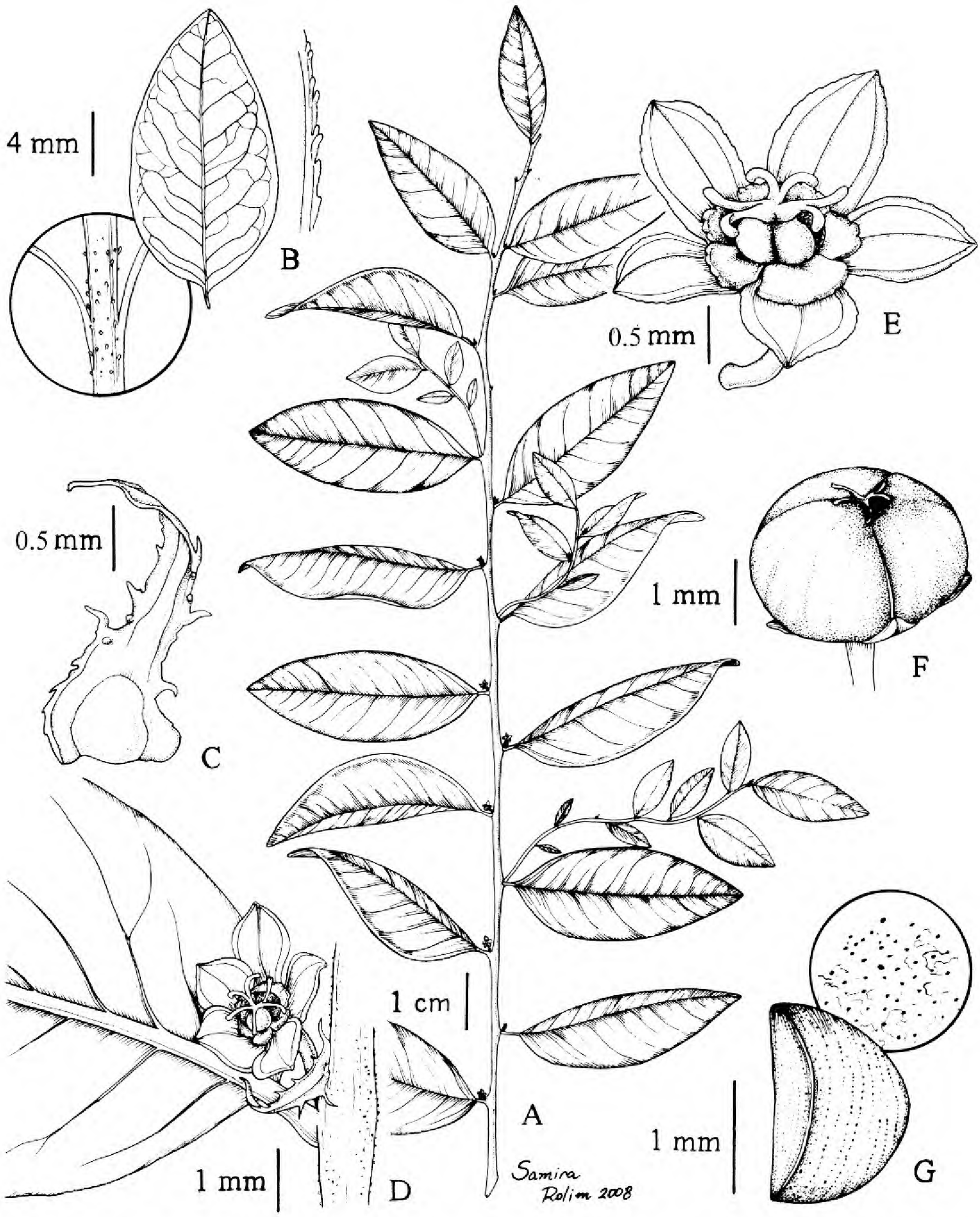

Figure 2. *Phyllanthus salesiae* M. J. Silva. —A. Flowering branch. —B. Leaf, showing the serrulate margins and trichomes at base and along midvein. —C. Stipule. —D. Detail of pistillate flower on branch. —E. Pistillate flower. —F. Fruit. —G. Seed and detail of the punctations on seed surface. Drawn from the type, *L. D. Meireles 2064* (UEC).

Relationships. *Phyllanthus* sect. *Antipodanthus* G. L. Webster was established by Webster (2002b). It comprises 15 species, five of which occur in Brazil: *P. dictyospermus* Müller Argoviensis, *P. pinifolius* Baillon, *P. ramillosus* Müller Argoviensis, *P. dawsonii* Steyermark, and *P. rosmarinifolius*. According to Webster (2002b), this section is characterized by shrubs or subshrubs that are monoecious or dioecious with unspecialized branching, papillate branches, spiral phyllotaxy, and persistent stipules. By virtue of its subshrub habit, unspecialized branching, papillate branches, verruculose seeds, persistent stipules,

Table 1. Comparison of *Phyllanthus salesiae* and related species.

	P. dawsonii	*P. dictyospermus*	*P. pinifolius*	*P. ramillosus*	*P. rosmarinifolius*	*P. salesiae*
Sex of plant	monoecious	dioecious	dioecious	dioecious	dioecious	dioecious
Branch indumentum	smooth	smooth	smooth	papillose	smooth	papillose
Leaf blade margins	plane	revolute	revolute	revolute	plane	plane
Seed surface	verruculose	reticulate and verruculose	foveolate-reticulate	reticulate	unknown	punctate
Leaf apex	acuminate	obtuse	mucronate	acuminate	obtuse	acute

and bifid styles, *P. salesiae* belongs to *Phyllanthus* sect. *Antipodanthus*.

Although *Phyllanthus salesiae* is poorly known, it can be positively described because it is the only species of the section with distichous phyllotaxy, leaf blades with serrulate margins, and pistillate flowers with a segmented disk. Among the other Brazilian species of section *Antipodanthus*, *P. salesiae* is morphologically similar to *P. rosmarinifolius*, but the latter differs by its smooth branches and its leaf blades, stipules, and pistillate disk all with entire margins.

The relationships among the Brazilian taxa of section *Antipodanthus* are poorly known, but Table 1 offers morphological characters for the comparison of *Phyllanthus salesiae* with other species of the section.

Acknowledgments. I am very grateful to the curator of the herbarium ALCB, Maria Lenise Guedes, for the loan of the voucher material of *Phyllanthus longipedicellatus*; to Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for providing funding for this study (grant 140609/2006-7); to Leonardo Dias Meirelles, who collected the type specimens of *Phyllanthus salesiae*; and to Victoria C. Hollowell (MO) for editorial advice.

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A New Species of *Hymenocallis* (Amaryllidaceae) from the Apalachicola Forest of the Florida Panhandle, U.S.A.

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Abstract. A new species, *Hymenocallis gholsonii* G. Lom. Smith & Garland (Amaryllidaceae), is described and illustrated. It is a rare endemic that occurs along a stream and its branches in the Apalachicola National Forest, in Liberty County, Florida, U.S.A. Its robust bulbs, narrowly oblanceolate, green-yellow leaves, and robust perianth tubes distinguish it from the allied *H. choctawensis* Traub, which has more slender bulbs, shiny green, prominently oblanceolate leaves, and slender perianth tubes.

Key words: Amaryllidaceae, Florida Panhandle, *Hymenocalllis*, IUCN Red List, United States.

In the United States, the genus *Hymenocallis* Salisbury (Amaryllidaceae) is most diverse in the Florida Panhandle. Within a 50-mile radius of Tallahassee, Leon County, in the central panhandle, can be found seven of the 15 U.S. species of *Hymenocallis* in their native habitats: *H. choctawensis* Traub, *H. duvalensis* Traub, *H. franklinensis* G. Lom. Smith, L. C. Anderson & Flory, *H. godfreyi* G. Lom. Smith & Darst, *H. henryae* Traub, *H. occidentalis* (Leconte) Kunth, and *H. rotata* (Ker Gawler) Herbert (Smith & Flory, 2002; Smith & Garland, 2003). Small (1933) and Traub (1962) indicated that *H. latifolia* (Miller) M. Roemer [= *H. kimballiae* Small] may have naturalized in coastal areas near Apalachicola, Franklin County. This remarkable diversity of *Hymenocallis* species in the central Florida Panhandle presents botanists with challenging problems of identification.

The *Hymenocallis* species with smaller ovaries (0.7–1.5 cm × 5–10 mm) and fewer ovules (1 to 3) are especially challenging to identify. Smith and Garland (1996) provided a key to identify three such species, *H. choctawensis*, *H. duvalensis*, and *H. occidentalis*, using leaf and bulb characteristics. Smith et al. (2001) added to this group when they described a new species, *H. franklinensis*, from the lower Ochlockonee River and its tributaries. *Hymenocallis franklinensis* is considered to be closely allied to *H. choctawensis*, but differs from that species by its liguliform or narrowly oblanceolate leaves, lanceolate scape bracts that taper in the distal half, and smaller subglobose fruits. *Hymenocallis franklinensis* differs from *H. gholsonii* G. Lom. Smith & Garland, newly introduced here, by its lustrous, green leaves, narrowly tapering scape bracts, slender perianth tubes, and smaller staminal cups. An ongoing phylogenetic study using both morphological and intersimple sequence repeat (ISSR) markers has revealed in a neighbor-joining analysis that *H. choctawensis* and *H. franklinesis* form a sister relationship and that *H. gholsonii* is sister to that relationship (Catherine Bush and Dollie Rollins, pers. comm.).

In 1991, Loran C. Anderson, then curator of the Florida State University Herbarium (FSU), called to the senior author's attention a puzzling specimen that John Palis of the Florida Natural Areas Inventory had collected in the Apalachicola National Forest near the town of Sumatra. This specimen had features similar to *Hymenocallis choctawensis*, but its perianth tubes were decidedly shorter and more robust, its staminal cup was larger, and its leaves were not distinctly oblanceolate but liguliform or narrowly oblanceolate.

It was not until spring of 2004 that the authors began to study intensively the Sumatra population. We were intrigued by the characteristics of this population and planned a critical analysis of both reproductive and vegetative characteristics. In 2005, the authors returned to this population, finding a number of plants at peak anthesis. We made careful observations and measurements, selected several choice flowering specimens as vouchers, and collected living bulbs for cytological analyses. In 2006, the senior author, with botanical associates, including Angus Gholson, returned to the population. We made additional observations on fruit development and seed production and compiled a comprehensive list of associated plants (see Distribution and ecological associates below).

Distinguishing characteristics of the new species include the relatively short, robust perianth tubes; a staminal cup that is relatively large (as compared to *H.*

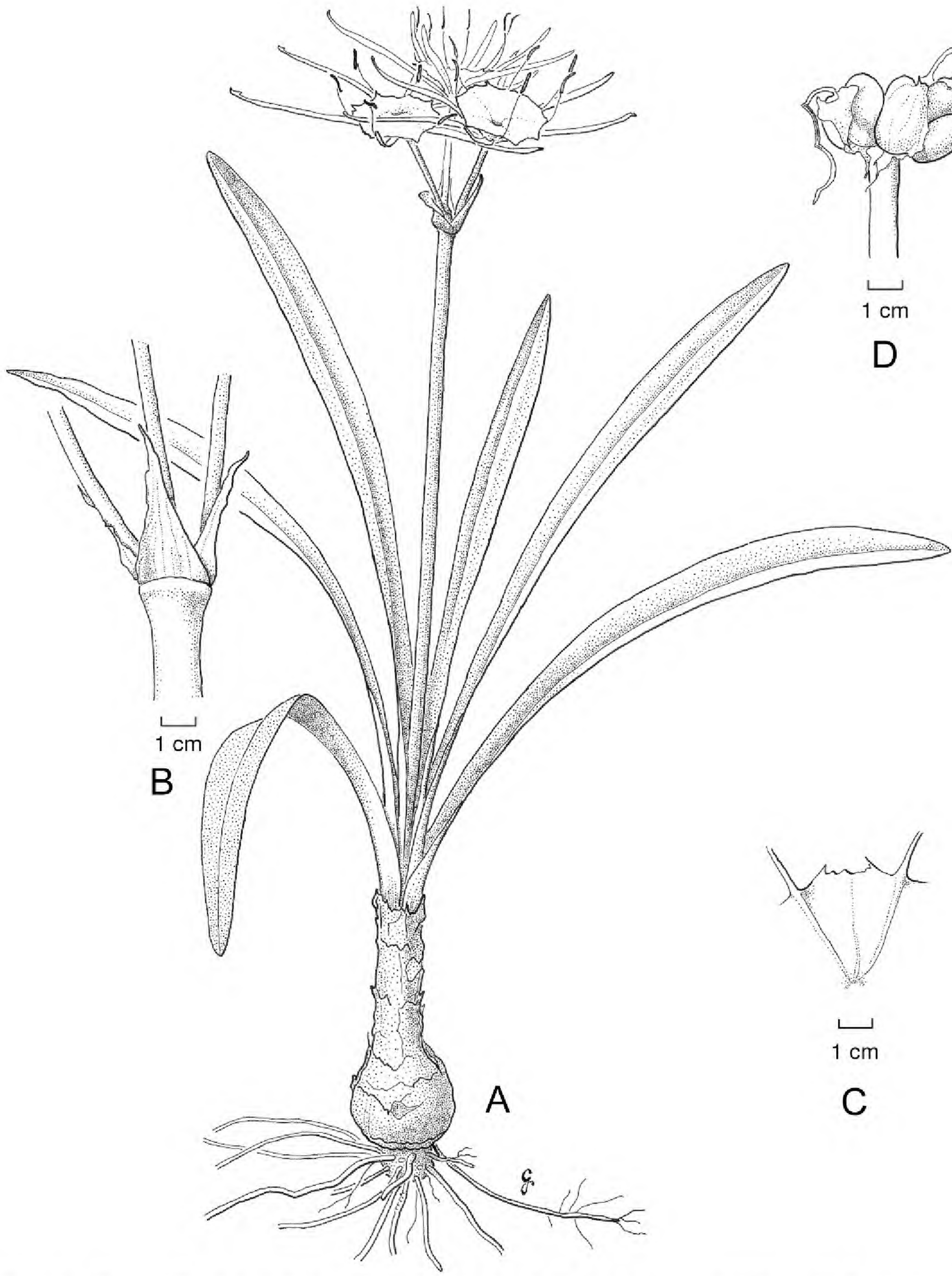

Figure 1. *Hymenocallis gholsonii* G. Lom. Smith & Garland. —A. Habit and scape with 3-flowered inflorescence. —B. Scape with bracts and bracteoles. —C. Section of staminal cup between free filaments. —D. Dehiscing capsule with seeds. (Drawn by Mark A. Garland based on *Smith & Garland 1784*.)

choctawensis) and rotate at peak anthesis; relatively large, lanceolate scape bracts; green-yellow, nearly erect, liguliform or narrowly oblanceolate leaves; and the robust, rhizomatous bulb.

Hymenocallis gholsonii G. Lom. Smith & Garland, sp. nov. TYPE: U.S.A. Florida: Liberty Co., stream in the Sumatra area, Apalachicola Natl. Forest, 7 Apr. 1991, *Palis s.n.* (holotype, FSU). Figure 1.

Hymenocallidi choctawensi Traub affinis sed ab ea bulbo robustiore, foliis flavoviridibus suberectis liguliformibus vel anguste oblanceolatis, bracteis scapi magnis lanceolatis, tubis perianthii brevioribus robustioribus, poculo staminorum majore sub plena anthesi rotato et numero chromosomatum: $2n = 44$ (bibrachiatorum 34, telocentricorum 10) distinguenda.

Bulb rhizomatous, robustly ovoid, 4.5–7.5 × 2.5–5.5 cm, neck 6–11 cm, basal plate 2–3 cm; tunica grayish brown. Leaves 3 to 9, erect to suberect, yellow-green, lustrous, liguliform to narrowly oblanceolate, prominently channeled, 4–6.5 dm × 2–4 cm, coriaceous, apex acute. Scape 2.7–4.3 dm, 2-edged, glaucous; 2 papery scape bracts enclosing the buds, 4–5 × 1.5–2 cm; each flower with a subtending bracteole, persistent, 3–4 × ca. 1 cm. Flowers 2 or 3, opening sequentially, fragrant; perianth segments radiating horizontally to slightly ascending, white, tinged green on keel, 9–11.5 cm × 7–8 mm; perianth tubes green, relatively robust in width, 6–7.5 cm; staminal cup white with a small yellow-green eye, rotate at peak anthesis, shortly tubular below, 3–4 × 4.8–5.5 cm; margin irregularly dentate between the free filaments; free filaments suberect, inserting on a flat sinal base, white, 2.5–3.5 cm; anthers 1.5–2 cm, pollen golden; styles green in distal third, fading to white, 14–15 cm; ovaries ovoid, ca. 1 cm × 5–7 mm; ovules 2 or 3 per locule. Fruits, subglobose to broadly trilocular, 2–2.5 × 2–3 cm. Seeds obovoid, 1.6–3.2 × 1–1.9 cm. Chromosomes $2n = 44$ (34 2-armed and 10 telocentric chromosomes).

Distribution and ecological associates. *Hymenocallis gholsonii* is a rare endemic with localized populations along one stream and its branches near Sumatra in the Apalachicola National Forest. The new species is found in association with the following herbaceous plants: *Carex folliculata* L., *Dichanthelium scabriusculum* (Elliott) Gould & C. A. Clark, *Eriocaulon decangulare* L., *Juncus polycephalus* Michaux, *Orontium aquaticum* L., *Pluchea* Cassini, *Pontederia cordata* L., *Rhynchospora microcarpa* Baldwin ex A. Gray, *Rhynchospora* Vahl, and *Sphagnum* L. Shrubs, vines, and trees include: *Acer rubrum* L., *Arundinaria gigantea* (Walter) Muhlenberg, *Cephalanthus occidentalis* L., *Chamaecyparis thyoides* (L.) Britton, Sterns & Poggenburg, *Cyrilla racemiflora* L., *Hypericum fasciculatum* Lamarck, *Quercus laurifolia* Michaux, *Smilax laurifolia* L., and *S. walteri* Pursh.

IUCN Red List category. *Hymenocallis gholsonii* is currently known from two locations in the same stream system. Its known area of occurrence is much smaller than 20 km². Both locations are in the Apalachicola National Forest and are therefore protected from many threats. Nevertheless, the species is so restricted that small disturbances can affect a large proportion of the entire population, causing it to become critically endangered or even leading to its extinction. The major plausible threat to this species is disturbance of habitat by road construction or maintenance; unauthorized collecting of bulbs may also be a threat to these showy plants. We therefore believe that this species should be considered Vulnerable (VU) according to criterion D2 in the IUCN Red List assessment: "Population with a very restricted area of occupancy (typically less than 20 km²) or number of locations (typically five or fewer) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period" (IUCN, 2001).

Etymology. It is with great pleasure that we name this new spider lily in honor of Angus K. Gholson, the 2007 recipient of the Elizabeth Ann Bartholomew Award presented by the Southern Appalachian Botanical Society. He has encouraged and supported

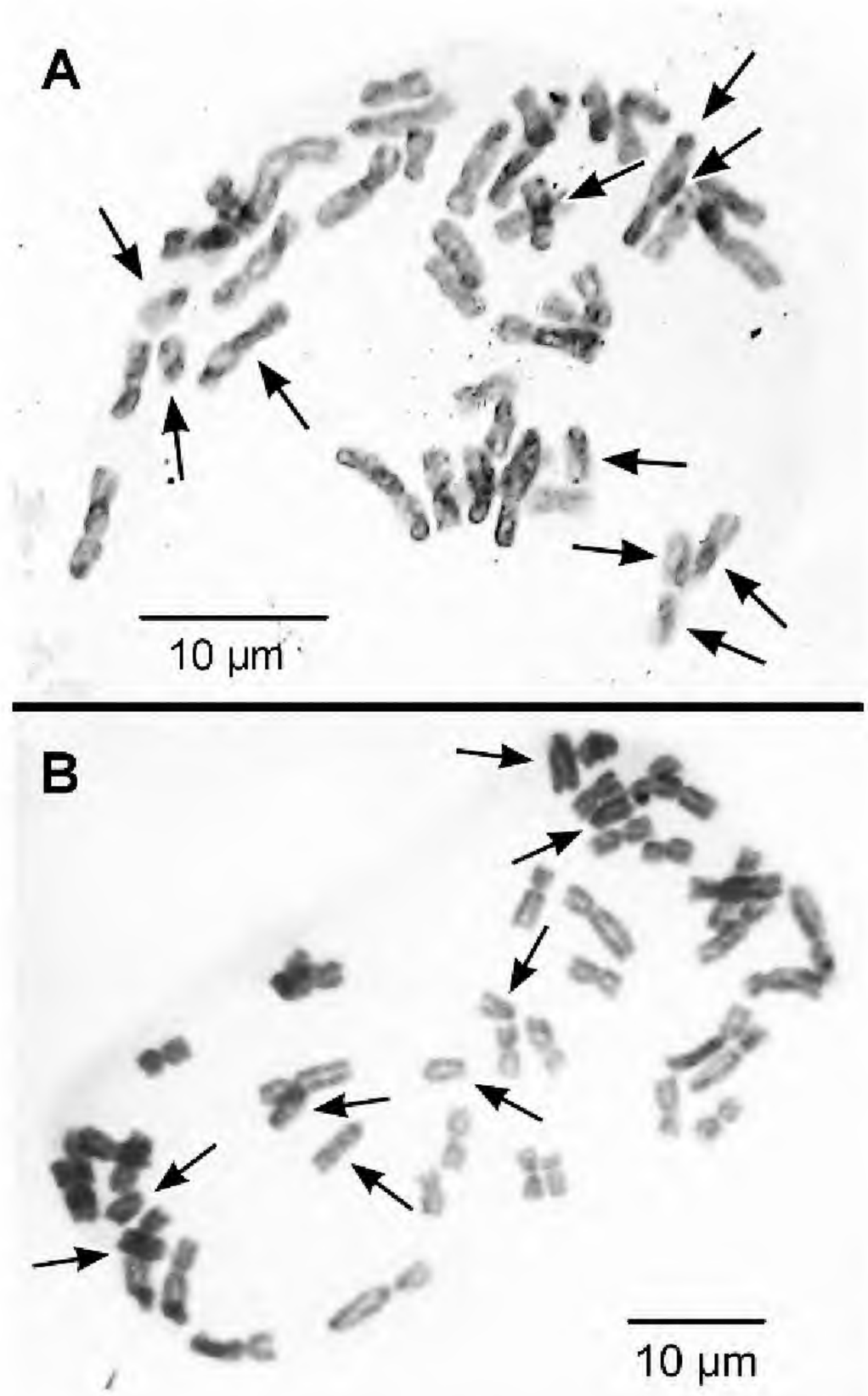

Figure 2. —A. Somatic chromosomes of *Hymenocallis gholsonii*, $2n = 44$, from *Smith & Garland 1784*. Arrows point to 10 telocentric chromosomes. —B. Somatic chromosomes of *Hymenocallis choctawensis*, $2n = 44$, from *Smith & Garland 1432* (FSU). Arrows point to 8 telocentric chromosomes.

our spider lily studies by always making available his herbarium in Chattahoochee, Florida, by assisting in the field, and by sending the senior author bulb and seed collections. Sometimes field trips were made with the late Robert K. Godfrey. A field day with "the dynamic Florida Panhandle duo of Gholson and Godfrey" was always highly regarded and long-remembered!

Cytology. The senior author analyzed the chromosome number and karyotype of mitotic cells in actively growing root tips from potted bulbs. The cytological techniques were those developed by Walter Flory and his graduate students at the Blandy Experimental Farm of the University of Virginia as outlined by Flory and Smith (1980) and by Smith in Jones and Luchsinger (1986). Well-spread metaphase figures were examined with a Wolfe microscope and photographed with a Canon digital camera.

Figure 2A represents a well-spread chromosomal figure of *Hymenocallis gholsonii*. The somatic count is $2n = 44$. This number is not entirely unexpected, because we consider this taxon to be allied to *H. choctawensis*, also $2n = 44$ (Fig. 2B). However, the karyotype of *H. gholsonii*, unlike that of *H. choctawensis*, consists of 10 telocentric chromosomes rather than 8, and the number of 2-armed chromosomes is 34 rather than 36. The karyotype of *H. gholsonii* is unique among the 16 U.S. *Hymenocallis* species for which karyotypes have been developed (Flory, 1976, 1978; Smith & Flory, 1990; Smith & Darst, 1994; Smith & Garland, 1996; Smith et al., 2001). *Hymenocallis gholsonii* likely evolved from *H. choctawensis* by the process of centric fission, which is discussed by Flory (1976) as a dynamic cytological process leading to speciation in *Hymenocallis*.

Our studies have revealed that *Hymenocallis gholsonii* is a rare endemic in scattered populations along a stream and its branches in the Sumatra area of the Apalachicola National Forest of the Florida Panhandle. We recognize it to be morphologically distinctive from all other known spider lilies in the southeastern United States based on its bulb type, leaves, and flowers with robust, stocky perianth tubes and rotate staminal cup at peak anthesis (Smith & Garland, 2007). Supporting the morphological distinctions is a unique karyotype.

Paratypes. U.S.A. **Florida:** Liberty Co., stream in the Sumatra area, Apalachicola National Forest, 22 May 2005, *G. L. Smith & M. Garland 1784* (FLAS, FSU, MO); 17 May 2006, *G. L. Smith, A. K. Gholson, M. Darst, G. Anglin & B. Niedenberger 1786* (HPU).

KEY TO *HYMENOCALLIS* SPECIES IN THE FLORIDA PANHANDLE

1a. Ovules 1 to 3(to 4) per locule; ovary 0.7–1.5 cm × 5–10 mm.
  2a. Bulb non-rhizomatous; leaves glaucous . . . . . *H. occidentalis*
  2b. Bulb rhizomatous; leaves shiny.
    3a. Scape bracts linear to narrowly lanceolate, width chiefly < 10 mm at widest point . . . . . *H. duvalensis*
    3b. Scape bracts lanceolate, width chiefly > 10 mm at widest point.
      4a. Leaves liguliform to narrowly oblanceolate.
        5a. Scape bracts 3–4(–4.5) × 1–1.5 cm; bulbs 2.5–4 cm long . . . . . *H. franklinensis*
        5b. Scape bracts 4–5 × 1.5–2 cm; bulbs 4.5–7.5 cm long . . . . . *H. gholsonii*
      4b. Leaves distinctly oblanceolate . . . . . *H. choctawensis*
1b. Ovules 4 to 8 per locule; ovary 1.4–3 cm × 6–15 mm.
  6a. Tepals yellow-green to green; bulb non-rhizomatous . . . . . *H. henryae*
  6b. Tepals white; bulb rhizomatous.
    7a. Staminal cup rarely wider than 6 cm; longest leaf not exceeding 4 dm at peak anthesis. . . . . *H. godfreyi*
    7b. Staminal cup 6 cm or wider; longest leaf greatly exceeding 4 dm at peak anthesis . . . . . *H. rotata*

Acknowledgments. We thank John Palis for his discovery of *Hymenocallis gholsonii*. We also thank Angus Gholson, Melanie Darst, Guy Anglin, and Bryan Niedenberger for their assistance in field documentation of *H. gholsonii* and in identification of plant associates. The Biology Department of High Point University provided partial funding for this study.

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La Sect. *Punctati* del Género *Lonchocarpus* (Leguminosae, Papilionoideae, Millettieae) para Mesoamérica

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RESUMEN. Se estudiaron las especies de *Lonchocarpus* Kunth sect. *Punctati* Bentham (Leguminosae) para Mesoamérica. De las 12 especies reconocidas, cinco son nuevas para la ciencia. Las especies nuevas, *L. angusticarpus* M. Sousa, *L. berriozabalensis* Miranda ex M. Sousa, *L. cristatus* M. Sousa, *L. linaresii* M. Sousa y *L. vittatus* M. Sousa, y una nueva combinación *L. vallicola* (Standley & F. J. Hermann) M. Sousa, se describen e ilustran. Se lectotípifican a *Cyanobotrys mexicana* Zuccarini y a *Derris peninsularis* Donnell Smith. Las especies mesoamericanas de la sect. *Punctati* se contrastan con una clave dicotómica.

ABSTRACT. An account of section *Punctati* Bentham for the genus *Lonchocarpus* Kunth in Mesoamerica is given. Of the 12 species treated, five are new to science, and one new combination is made, *L. vallicola* (Standley & F. J. Hermann) M. Sousa. The new species described and illustrated here are *L. angusticarpus* M. Sousa, *L. berriozabalensis* Miranda ex M. Sousa, *L. cristatus* M. Sousa, *L. linaresii* M. Sousa, and *L. vittatus* M. Sousa. *Cyanobotrys mexicana* Zuccarini and *Derris peninsularis* Donnell Smith are lectotypified. The Mesoamerican species of section *Punctati* are contrasted with a dichotomous key.

Key words: IUCN Red List, Leguminosae, *Lonchocarpus*, Mesoamerica, Millettieae, sect. *Punctati*.

El género *Lonchocarpus* Kunth (Fabaceae, Millettieae) esta integrado por alrededor de 150 especies de los trópicos de América, con un representante en la costa occidental de África ecuatorial. La sect. *Punctati* Bentham comprende alrededor de 22 especies. Está bien representada en Mesoamérica con 12 especies, de las cuales siete son endémicas; en México se cuentan con 13 especies, incluyendo a 11 endémicas; en Sudamérica con sólo tres, todas ellas endémicas; y en las Antillas Menores una endémica.

Bentham (1860) propone la sect. *Punctati* Bentham y ubica en ella a cuatro especies: *Lonchocarpus violaceus* sensu Bentham, *L. confertiflorus* Bentham, *L. araripensis* Bentham y *L. subglaucescens* Martius ex Bentham. Bajo *L. violaceus* Bentham (non Oliver, non (Jacquin) Kunth ex A. DC.), cuyo basónimo *Robinia violacea* Jacquin como nombre, más no como planta, Bentham coloca como sinónimo a *L. punctatus* Kunth.

Pittier (1917) y Urban (1921), aparentemente, en forma independiente concluyeron que *Robinia violacea* Jacquin (Enum. Syst. Pl. 28. 1760) no se podía identificar con los conceptos de especies propuestos por Bentham (1860) y Kunth ex A. DC. (de Candolle, 1825), por lo que para las Antillas Menores era necesario crear un nuevo nombre (*Lonchocarpus benthamianus* Pittier [Pittier, 1917] y *L. caribaeus* Urban [Urban, 1921]) y para el caso de Sudamérica Pittier (1917) emplea a *L. punctatus* Kunth.

Robinia violacea Jacquin, se basa a su vez en un polinomio de Plumier "Pseudo acacia fraxini folio floribus violaceis" (Plumier, 1703). Lourteig (1988) estudió las láminas inéditas de Plumier (bajo el actual resguardo de P) de *Lonchocarpus* y no identifica a ninguna especie de *Lonchocarpus* en particular para este polinomio. La descripción y figura de Jacquin (1760) es bastante general y podría parecerse a varias especies y no es posible con seguridad referirla al concepto de *L. punctatus*, particularmente difiere de él, ya que *R. violacea* se describe con folíolos con el ápice obtuso (vs. acuminado) y pedícelos cortos (vs. 6–7 mm de largo). *Robinia violacea* es citada de Cartagena, Colombia, el problema es que en esa área crecen varias especies de *Lonchocarpus*, incluyendo a *L. punctatus*, y resulta arriesgado que por un simple proceso de eliminación las homologuemos, por lo que *R. violacea* es mas adecuado como un nombre de identificación incierta, que sin embargo, podría corresponder a una especie de *Lonchocarpus*.

Atendiendo a la última edición del *Código Internacional de Nomenclatura Botánica*, McNeill et al. (2006: art. 22.6) se indica: "Cuando el epíteto en el nombre de una subdivisión [sección] de un género es idéntico al, o derivado del, epíteto de una especie [*Lonchocarpus punctatus*, como sinónimo] que lo constituyen, el tipo del nombre de la subdivisión del género [*Punctati*] es el mismo que el del nombre de esa especie [*L. punctatus*], a menos que el autor original [Bentham] del nombre de la subdivisión [sección] designara otro tipo [lo que no hizo Bentham]" (traducción por el autor). Por lo anterior

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Bentham designó, sin ser explícito, automáticamente el lectotipo de la sect. *Punctati*.

De las especies incluidas por Bentham (1860) en la sect. *Punctati* sólo se consideran aquí dentro de la sect. *Punctati* a *Lonchocarpus punctatus* (como sinónimo de *L. violaceus* Bentham) y *L. confertiflorus*. Se excluyen a *L. araripensis* y *L. subglaucescens* ambas relacionadas entre sí, pero que conforman otro grupo diferente, a pesar de que también presentan áreas pelúcido linear-punteadas. Teixeira et al. (2000) estudiaron el posible significado taxonómico de las cavidades de secreción de las puntuaciones pelúcidas en el mesófilo de los folíolos de *Lonchocarpus*; en base a este cáracter sugieren posibles cambios taxonómicos, como el agrupar junto a *L. punctatus* (*L. violaceus* (Jacquin) A. DC., según los autores), bajo el subgénero *Punctati* (sensu Teixeira et al., 2000), sin ser caracterizada ésta categoría, a los siguientes grupos, el primero alrededor de *L. subglaucescens* y *L. araripensis* [grupo aparte tanto morfológica, fitoquímica como genéticamente]; y el segundo en torno *L. monilis* (L.) A. M. G. Azevedo [el cual debe considerarse en el género *Muellera* L. f., del cual es el tipo, o bien ubicarse en otra sección diferente en el género *Lonchocarpus*]. Por otro lado, Teixeira et al. (2000) evalúan excluir a *L. grandiflorus* A. M. G. Azevedo del subgénero *Punctati* (sensu Teixeira et al., 2000) por carecer de cavidades de secreción, pero por lo demás esta especie pertenece al grupo de *L. subglaucescens* y ellos proponen su inclusión dentro del subgénero *Lonchocarpus* (sensu Teixeira et al., 2000). Así *L. denudatus* Bentham y *L. montanus* de Teixeira et al. (2000), los caules también carecen de cavidades de secreción, y sin embargo pertenecen al mismo grupo (*Muellera*) junto con *L. monilis* especie que sí las tiene.

Tratamiento Taxonómico

Lonchocarpus sect. **Punctati** Bentham, J. Linn. Soc. Bot. 4 (Suppl.): 96. 1860. TIPO: *Lonchocarpus punctatus* Kunth, Nov. Gen. Sp. (folio ed.) 6: 300. 1823 [1824]; (quarto ed.) 6: 384. 1823 [1824].

La sect. *Punctati* se caracteriza por: corteza interior no exuda resina rojiza al corte; hojas con arreglo marcadamente dístico en el tallo; estípulas pequeñas redondeadas a ligulares, pronto caducas; hojas frecuentemente glabras, sobre todo en el haz, esparcidamente pelosas a glabras y papilosas en el envés, los folíolos frecuentemente pelúcidos punteados, con cavidades de secreción en el mesofilo; pedúnculos florales y pedicelos delgados y generalmente largos, las bractéolas generalmente pequeñas, frecuentemente escariosas y distantes de la base del cáliz; botones florales elipsoidales a esféricos; cáliz trunco a casi trunco, esparcidamente seríceo a glabro, generalmente pelúcido linear-punteado; corola frecuentemente pelúcido linear-punteada, el estandarte abaxialmente en la base 2-lobado y calloso, en ocasiones esparcidamente canescente seríceo en el centro y base. Mecanismo floral ligeramente explosivo. Legumbre indehiscente a dehiscente sólo en el margen vexilar, aplanada, frecuentemente resinosa, la resina transparente brillosa y frecuentemente cubriendo a las semillas, las valvas lisas a crestadas, el margen vexilar en ocasiones angostamente alado. Plántulas con los cotiledones epigeos en ocasiones hipogeos, eófilos opuestos 1(3)-foliolados, 1ª hoja alterna 1- a 3-foliolada.

Clave Para las Especies de *Lonchocarpus* sect. *Punctati* de Mesoamérica

1a. Legumbres dehiscentes sólo en el margen vexilar.
  2a. Plantas completamente glabras aún en los brotes vegetativos; folíolos maduros con los márgenes revolutos; legumbres con el margen vexilar nervado; semillas no embebidas en tejido esponjoso blanquecino. . . . . 11. *L. vallicola*
  2b. Plantas pelosas en los brotes vegetativos y envés de los folíolos; folíolos maduros con los márgenes no revolutos; legumbres con el margen vexilar engrosado; semillas embebidas en un tejido esponjoso blanquecino . . . . . 2. *L. angusticarpus*
1b. Legumbres indehiscentes.
  3a. Legumbres subleñosas a leñosas.
    4a. Pedúnculos florales 2–3 mm; botones florales casi esféricos; legumbres con el margen vexilar alado . . . . . 1. *L. acuminatus*
    4b. Pedúnculos florales 4–11 mm; botones florales elipsoidales; legumbres con el margen vexilar angostamente aquillado, sin ala.
      5a. Folíolos con el envés canescente pubescente; inflorescencias 19–24 cm; flores ca. 19 mm. . . . . 4. *L. chiricanus*
      5b. Folíolos con el envés glabrescente; inflorescencias 8–17 cm; flores (10–)12–13 mm . . . 5. *L. cochleatus*
  3b. Legumbres con textura cartácea a coriácea.
    6a. Hojas 7- a 19-folioladas.
      7a. Folíolos canescente seríceos en el envés.
        8a. Legumbres cartáceas, el margen vexilar alado, el ala 1–1.3 mm de ancho; semillas con bandas y manchas irregulares . . . . . 12. *L. vittatus*
        8b. Legumbres subcoriáceas, coriáceas a subleñosas, el margen vexilar alado, el ala 2–4 mm de ancho, semillas sin bandas ni manchas irregulares.

9a. Hojas hasta 13-folioladas; pedúnculos florales 3–7 mm de largo; botones florales elipsoidales; flores 13–16 mm de largo . . . . . 9. *L. michelianus*
9b. Hojas hasta 9-folioladas, generalmente 7-folioladas; pedúnculos florales 2–3 mm de largo; botones florales casi esféricos; flores 10–11 mm de largo. . . . . .1. *L. acuminatus*
7b. Folíolos glabros en el envés.
10a. Hojas espaciadas; folíolos acuminados a subcaudados; pedúnculos florales (2–)4–6(–9) mm; lámina del estandarte 11–13 mm de ancho . . . . . 8. *L. longistylus*
10b. Hojas congestas; folíolos corto acuminados a obtusos; pedúnculos florales 1.5–3 mm; lámina del estandarte 9–10 mm de ancho . . . . . .3. *L. berriozabalensis*
6b. Hojas 3- a 5-folioladas.
11a. Pedicelos 6–9 mm; valvas de la legumbre con crestas y tubérculos suberosos . . . . . .6. *L. cristatus*
11b. Pedicelos 2–5 mm; valvas de la legumbre lisas a algo rugosas.
12a. Flores 10–11 mm; legumbres 2.3–3.5(–4) cm de ancho; plántulas con los cotiledones hipogeos . . . . . 1. *L. acuminatus*
12b. Flores 12–16 mm; legumbres 1.7–2.1 cm de ancho; plántulas con los cotiledones epigeos.
13a. Folíolos brillantes en el haz; inflorescencias péndulas; flores 12–14 mm; legumbres con el margen vexilar surcado. . . . . 10. *L. trifolius*
13b. Folíolos opacos en el haz; inflorescencias erectas a patentes; flores 14–16 mm; legumbres con el margen vexilar alado . . . . . 7. *L. linaresii*

1. Lonchocarpus acuminatus (Schlechtendal) M. Sousa, Ann. Missouri Bot. Gard. 73: 724. 1987. Basónimo: *Robinia acuminata* Schlechtendal, Linnaea 12: 306. 1838. TIPO: México. Veracruz: Mapilque [Malpica], 28 dic., *C. J. W. Schiede s.n.* (lectotipo, designado por Sousa [1987: 724], HAL no vista, foto MEXU).

Lonchocarpus chiapensis Lundell, Wrightia 1: 152. 1946. TIPO: México. Chiapas: Pinuela near Escuintla, 700 m, 19 Feb. 1945, *E. Matuda 5008* (holotipo, LL; isotipos, MEXU, MO).

Lonchocarpus nicaraguensis Lundell, Wrightia 1: 154. 1946. TIPO: Nicaragua. Managua: Lago de Nejapa, 19 ene. 1945, *S. S. White y C. L. Gilly 5365* (holotipo, MICH; isotipos, ENCB, LL).

Lonchocarpus nicoyensis (Donnell Smith) Pittier, Contr. U.S. Natl. Herb. 20: 57. 1917. Syn. nov. Basónimo: *Derris nicoyensis* Donnell Smith, Bot. Gaz. 44: 111. 1907. TIPO: Costa Rica. Puntarenas: Península Nicoya, dic. 1899, *A. Tonduz ex J. D. Smith 13547* (holotipo, US; isotipo, K).

Lonchocarpus peninsularis (Donnell Smith) Pittier, Contr. U.S. Natl. Herb. 20: 56. 1917. Syn. nov. Basónimo: *Derris peninsularis* Donnell Smith, Bot. Gaz. 44: 111. 1907. TIPO: Costa Rica. Puntarenas: Península Nicoya, mayo 1900, *A. Tonduz ex J. D. Smith 13966* (lectotipo, aquí designado, US; duplicados, G, GH, K, LE, NY).

Lonchocarpus purpusii Brandegee, Univ. Calif. Publ. Bot. 6: 500. 1919. TIPO: México. Veracruz: Corral de Piedras, Zacuapam, oct. 1917, *C. A. Purpus 7849* (holotipo, UC; isotipos, A, GH, MO, US).

Lonchocarpus acuminatus es una especie muy variable, en cuanto a la pelosidad de su cáliz y pedicelos, textura y tamaño de sus frutos y al número de folíolos por hoja, lo cual se refleja en la clave de la sección donde aparece en tres entradas.

En cuanto a la selección de *A. Tonduz ex J. D. Smith 13966* como lectotipo de *Derris peninsularis* en lugar del otro sintipo *A. Tonduz ex J. D. Smith 13812* se debió a que el material es más completo por incluir tanto material en flor como en fruto, en cambio el otro sintipo sólo cuenta con material en flor.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus acuminatus* debe considerarse como: casi amenazada (NT), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie de amplia distribución, pero sus habitats están siendo alterados o destruidos.

Material representativo. COSTA RICA. **Alajuela:** *A. M. Brenes s.n.* (CR, DS). **Guanacaste:** *U. Chavarría et al. 1572* (F, MEXU). **Puntarenas:** *W. Haber 413, 10655* (MEXU, MO). **San José:** *Q. Jiménez 916* (MO), *N. Zamora 1518* (MO), *R. Zúñiga 526* (US). EL SALVADOR. **La Libertad:** *G. P. Lewis y C. E. Hughes 1738* (K, MEXU), *A. K. Monro et al. 3403* (BM, MEXU). **San Salvador:** *L. A. Pérez J. y J. González 149* (MEXU). **San Vicente:** *P. C. Standley 21214* (GH, NY, US). **Santa Ana:** *J. L. Linares 4679* (MEXU). GUATEMALA. **Huehuetenango:** *R. Ávila c6* (USCG). MÉXICO. **Chiapas:** *D. E. Breedlove 52752* (CAS, MEXU), *A. Reyes-García 6829* (MEXU), *Sousa 6652* (MEXU). **Hidalgo:** *A. May Nah 59* (INIF). **Oaxaca:** *A. Campos V. 5149* (MEXU), *Sousa 8735* (MEXU), *R. Torres C. 9229* (MEXU). **Veracruz:** *J. I. Calzada 12755, 13098* (MEXU, XAL), *M. Sousa 3408* (MEXU). NICARAGUA. **Carazo:** *P. Moreno y J. C. Sandino 6511* (MEXU, MO). **Chontales:** *W. D. Stevens 19050* (MEXU, MO). **Managua:** *P. Moreno 18967* (MEXU, MO). **Rivas:** *P. Moreno y W. D. Stevens 22867* (MEXU, MO). PANAMÁ. **Bocas del Toro:** *H. von Wedel 1180* (MO).

2. Lonchocarpus angusticarpus M. Sousa, sp. nov. TIPO: México. Chiapas: La Chacona, 16°47′25″N, 93°10′44″O, árbol de 7 m de alto con flores violeta, 529 m, 10 ago. 1998, *E. Martínez S., C. H. Ramos, J. Linares y M. Goretti C. 31214* (holotipo, MEXU; isotipos, A, BM, K, MEXU, MO, NY, US). Figura 1.

Haec species *Lonchocarpo caudato* Pittier similis, sed ab eo foliolis 7 ad 9 (vs. 5 ad 7), inflorescentia (3–)7–10(–12) cm (vs. [5–]10–22[–30] cm) longa, fructu 1.4–1.6 cm (vs. 2.5–3.3 cm) lato, margine vexillari incrassato (vs. alato) et seminibus in textura spongiosa albida immersis differt.

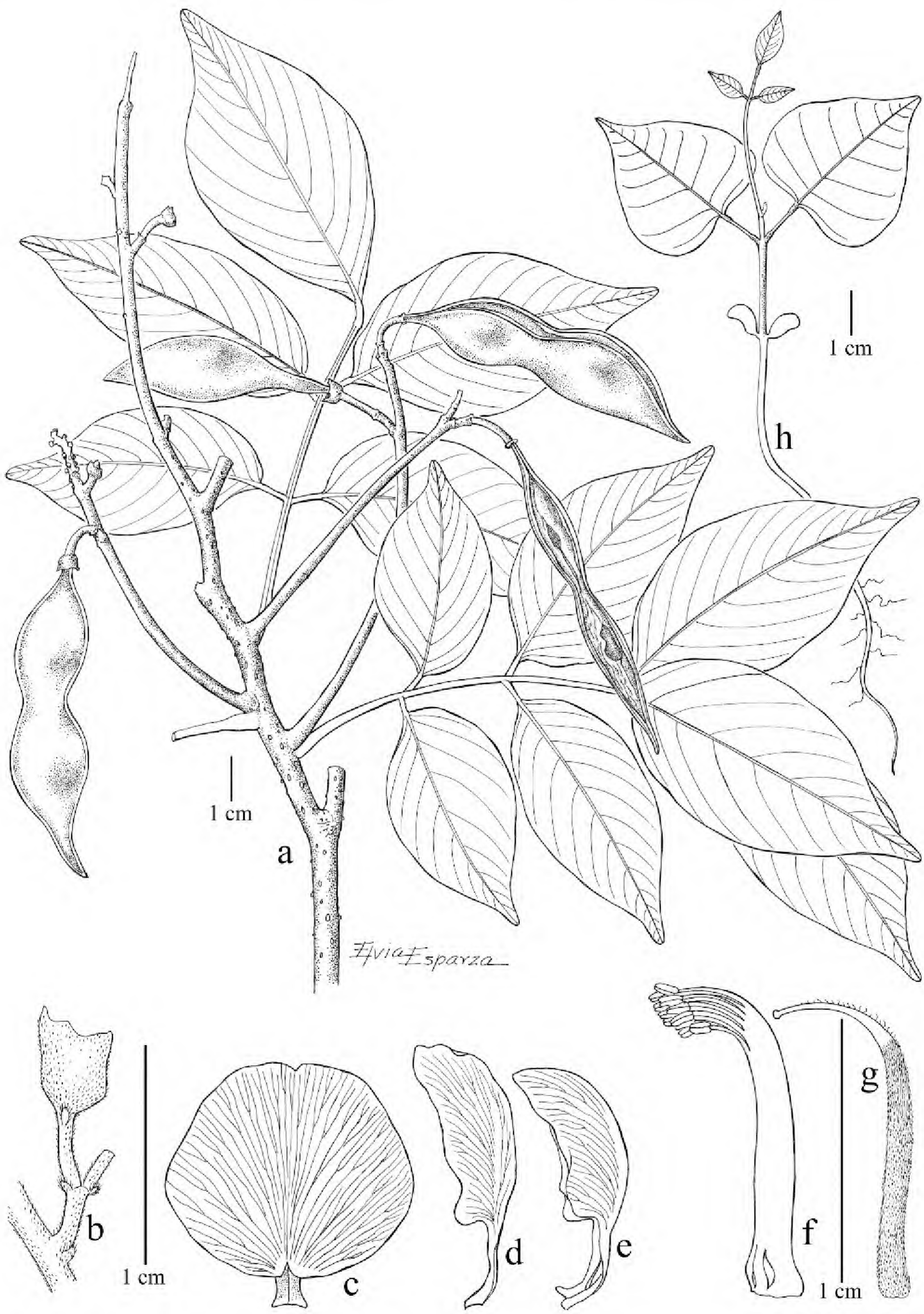

Figura 1. *Lonchocarpus angusticarpus* M. Sousa. —A. Rama con hojas e infrutescencias. —B. Unidad biflora de la inflorescencia, mostrando brácteas y bractéolas. —C. Estandarte. —D. Ala. —E. Quilla. —F. Tubo estaminal. —G. Gineceo. —H. Plántula. (Tomado de *Sousa 9068*.) (A, H de *Sousa et al. 9068*; B–G de *R. Torres y Lavin 6890*.)

Arbolitos a árboles (2–)4–16(–20) m, caducifolios; corteza sin fluido resinoso rojizo al corte; ramas densamente canescente seríceas en brotes, pronto glabras. Hojas con arreglo dístico en el tallo; estípulas 0.7–0.8 × ca. 0.5 mm, ligulares, pronto caducas; pecíolo (2.8–)3.2–5 cm, canaliculado; hojas (5)7- a 9-folioladas; folíolos 3.5–6(–9.5) × (1.2–)2–2.4(–3.8) cm, angosta a anchamente elípticos, lanceolados,

pelúcido punteados, ligeramente discoloros, la base cuneada a redondeada, los márgenes generalmente ondulados, el ápice acuminado a caudado, el haz opaco y glabro, el envés esparcidamente canescente pubescente a seríceo, más densamente sobre las nervaduras, papiloso; nervaduras primaria y secundarias ligeramente realzadas en el envés, nervaduras secundarias 7 a 10. Inflorescencias (3–)7–10(–12) cm, erectas, densifloras, pedúnculos 2–4 cm; floración tardía; pedúnculos florales 1.5–3 mm, delgados; pedicelos 3–6(–8) mm; bractéolas 0.4–0.8 mm, ovadas, escariosas, opuestas a subopuestas, del 1/2–1/4 superior del pedicelo. Botones florales elipsoidales. Flores 9–12 mm; cáliz 2.5–3 mm, ciatiforme, densamente pelúcido linear-punteado, esparcido a moderadamente pardo-amarillento seríceo, ciliolado en el margen, cortamente lobado, el diente carinal prominente, hasta 0.3 mm; corola lila a púrpura, moderadamente con líneas y puntos translúcidos, la lámina del estandarte 9–11(–13) mm de ancho, orbicular a oblata, ligeramente cóncava, adaxialmente esparcidamente canescente serícea, más densamente sobre la base, abaxialmente esparcidamente canescente serícea sobre las nervaduras, particularmente en la base; ovario 4- a 7(9)-ovulado. Legumbre 3–5 cm de largo con 1 semilla, 6.5–9 cm con 2 semillas, 10–12 con 3 y 4(5) semillas, 1.4–1.6(–2) cm de ancho, elíptica a oblonga, dehiscente sólo en el margen vexilar, aplanada, coriácea, resinosa, recta a constricta entre las semillas sobre los márgenes, glabra, corto estipitada, margen vexilar engrosado, margen carinal aquillado, el ápice rostrado; semillas 1 a 3(5), 10.2–12.2 × 6–7 mm, color castaño a castaño oscuro, la semilla embebida en un tejido esponjoso blanquecino. Plántulas con los cotiledones epigeos; eófilos opuestos, 1-foliolados, la 1ª hoja alterna 3-foliolada.

Distribución y hábitat. Esta especie habita los Valles Centrales y cuenca del Río Tehuantepec en Oaxaca y la Depresión Central de Chiapas, prospera en selvas bajas caducifolias y ecotonía con bosques de encino-pino, encinares, riparia en ríos de temporal, cañadas, sobre suelos de litosol granítico y calizos; crece en altitudes de 550 a 1700 m.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus angusticarpus* debe considerarse como: preocupación menor (LC), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie relativamente localizada, pero localmente abundante, en un área relativamente conservada.

Fenología. La floración va de finales de mayo a principios de agosto; la fructificación de finales de octubre a finales de marzo.

Etimología. El epíteto hace énfasis en lo angosto del fruto.

Nombre vulgar. Armadillo (*M. Sousa 7543*, MEXU, Oaxaca).

Discusión. Esta especie es cercana a *Lonchocarpus caudatus* del occidente de México. *Lonchocarpus angusticarpus* se caracteriza por sus inflorescencias más cortas, frutos angostos, dehiscentes, con el margen vexilar engrosado, y semillas embebidas en un tejido esponjoso blanquecino.

Paratipos. MÉXICO. **Chiapas:** Mpio. Cintalapa de Figueroa, a 1 km de los límites de Oaxaca con Iris, carr. Tehuantepec–Rizo de Oro, *E. Martínez S. y G. Aguilar 36801* (MEXU); Chiapas, carr. a Rizo de Oro, *J. I. Calzada 14140* (XAL); a 24 km al NE de Tapanatepec (Oaxaca), *M. Sousa 8321* (MEXU); a 0.8 km al N-NO del Mirador, *Martínez S. y C. H. Ramos 37060* (MEXU); Ejido La Majada, Res. Biósfera La Sepultura, *A. Reyes-García, D. Gómez, E. Figueroa 6875* (MEXU); La Sepultura a 3 km al S (Rizo de Oro) Nuevo Tenochtitla, al N Mirador Iris, *M. Sousa, G. Andrade, G. Sousa A. y M. L. Sousa A. 13535* (Ecosur, San Cristóbal de las Casas, Chiapas; MEXU); Mpio. San Fernando, arriba de La Chacona, NO de Tuxtla Gutiérrez, *F. Miranda 5591, 6489, 6813, 7486* (MEXU); Mpio. Tuxtla Gutiérrez, steep slope at El Sumidero, 22 km N of Tuxtla Gutiérrez, *D. E. Breedlove 10664* (F, MICH); N of Tuxtla Gutiérrez, toward Chicoasen, ca. 500 m after turnoff to Juan Crispín, 10 km from Tuxtla Gutiérrez, *C. E. Hughes 1491* (MEXU); a 8 km al O de Tuxtla Gutiérrez, al O de la Colonia Juan Crispín, *Reyes García y R. Hampshire 1962* (MEXU). **Oaxaca:** Distr. Juchitán, Cerro Verde, 1.7 km al NE de Nizanda, Mpio. Asunción Ixtlaltepec, *E. Pérez-García y B. Reyes Ríos 1809* (MEXU); a 17 km al NO de La Ventosa, *M. Sousa y L. Rico 10201* (ENCB, MEXU); a 10–11 km al O de La Chiviza, hacia Lachiguiri, *R. Torres y C. Martínez 5714, 5740* (MEXU); Distr. Pochutla, Rancho San Agustín, Mpio. San Miguel del Puerto, *J. Pascual 804* (MEXU); Llano del Horno, *S. Salas M. y J. Pascual 5147* (MEXU); Distr. Tehuantepec, carr. a Tenango, 15 km al SO de Buenos Aires, Mpio. San Miguel Tenango, *A. Campos 3776* (MEXU); Santiago Lachiguiri, about 25 km N of Presa Benito Juárez and of Santa María Jalapa del Marques, *C. E. Hughes, G. P. Lewis & J. L. Contreras 1347* (MEXU, NY); El Sapotal, 37 km al O de Tehuantepec, entrando a Pozo Zorrillo a 1 km al NO de Tehuantepec, Mpio. Tehuantepec, *C. Martínez 1141* (MEXU); Cerro Calderona, estación microondas, a 7 km al S de Jalapa del Marqués, *M. Sousa, L. Rico y P. Basurto 10118* (MEXU); Cerro Guiengola, *L. Torres y C. Matínez 106, 143* (MEXU); a 12 km al SO de La Reforma, hacia Sta. María Ecatepec, *R. Torres y C. Martínez 5635* (MEXU); a 8.1–12 km al SO de Buenos Aires, camino a Tenango, *R. Torres y C. Martínez 7344, 10498* (MEXU); Distr. Tlacolula, 10 km al N-NO de S. Pedro Totolapan, Mpio. Totolapan, *S. Acosta 750* (MEXU, OAX); Barranca de Los Calabazos, a 3 km al O de Totolapan, *Acosta 985* (MEXU, OAX); a 7 km al NO de Santa María Zoquitlán, *R. Cedillo y R. Torres 1394* (MEXU); a 8 km al NO de Totolapan, *Cedillo y R. Torres 1569* (ENCB, MEXU); Tlacolula, *L. Cervantes y A. García 2102* (MEXU); Cam. Pino Suárez a Duraznillo, Mpio. Totolapan, *A. Flores M. 1333* (ENCB, MEXU, OAX, XAL); a 4 km al O de Totolapan, *Flores 1349* (ENCB, MEXU, OAX); Portillos de San Dionisio, 13 km al S-SE de Matatlán, *J. Rzedowski 34384* (MEXU); a 10 km de la desv. Portillo San Dionisio rumbo a Totolapan,

A. Saynes 1287 (ENCB, MEXU, OAX); El Ciruelo, a 8 km al N-NO de Totolapan, *M. Sousa, O. Téllez, A. S. Magallanes y A. Delgado 7543* (MEXU); Agua Santa, a 12 km al NO de Totolapan, *M. Sousa y O. Téllez 8556* (MEXU); a 7 km al N de Totolapan, *M. Sousa, O. Téllez y L. Rico 9068* (ENCB, MEXU); a 11 km al SE de Totolapan, *R. Torres y H. Hernández 3401* (MEXU); entre Totolapan y Guelavila, *R. Torres y M. Lavin 6890* (MEXU); Distr. Yautepec, entrada del camino a Santa María Ecatepec, al O de La Reforma, Mpio. Santa María Ecatepec, *C. Martínez 1489* (MEXU); Los Tunillos, a 2 km al E-NE de La Reforma, *M. Sousa, O. Téllez, A. S. Magallanes y A. Delgado 7488* (MEXU); a 6 km al E de El Camarón, *M. Sousa, O. Téllez, A. S. Magallanes y A. Delgado 7534* (MEXU); El Laurel, a 12 km al NO de El Coyul (Coyula), Mpio. San Juan Lajarcia, *M. Sousa y O. Téllez 8597* (ENCB, MEXU); 3 km al NO de El Coyul, Mpio. San Juan Lajarcia, *R. Torres, L. Cortes, C. Martínez 9870* (MEXU).

3. Lonchocarpus berriozabalensis Miranda ex M. Sousa, sp. nov. TIPO: México. Chiapas: a 38 km al O de Tuxtla Gutiérrez, a 10.6 km al S de Coita (Ocozocoautla), 16°39′43″N, 93°25′19″O, vegetación selva mediana subperennifolia, suelo calizo (sobre el Maciso Cerro Brujo), 762 m, 13 jul. 2004, *J. Calónico y D. Álvarez 25566* (holotipo, MEXU; isotipos, A, BM, K, MEXU, MO, NY, TEX, US). Figura 2.

Haec species *Lonchocarpo longistylo* Pittier similis, a quo foliis in caule congestis usque ad 13- (vs. 19-)foliolatis, foliolis brevibus apice acuminatis vel obtusis, pedunculis floralibus 1.5–3 mm longis (vs. [2–]4–6[–9] mm), pedicellis 2.5–4 mm longis (vs. [3–]4–7 mm) et vexilli lamina 9–10 mm (vs. 11–13 mm) lata differt.

Árboles 6–25 m; corteza lisa, sin fluido resinoso rojizo al corte, ramas esparcidamente canescente pubescentes, pronto glabras. Hojas con arreglo dístico en el tallo, congestas dando la apariencia en ocasiones de casi opuestas; estípulas no encontradas; pecíolo 4.5–7 cm, acostillado; hojas (9)11- a 13-folioladas; folíolos (4.5–)6–7.5(–9) × 2.5–3.8 cm, elípticos, subcoriáceos, pelúcido punteados, concoloros, la base algo oblicua, cuneada, los márgenes rectos, el ápice corto acuminado a obtuso, el haz opaco, glabro, el envés glabro, escasamente papiloso; nervaduras primaria y secundarias ligeramente realzadas en el envés, 5–11 pares de nervaduras secundarias. Inflorescencias 9–18 cm, erectas, densifloras, pedúnculo 4–5.5 cm; floración tardía; pedúnculos florales 1.5–3 mm, delgados; pedicelos 2.5–4 mm; bractéolas 0.6–0.7 mm, ovadas a orbiculares, escariosas, opuestas a subopuestas, del 1/3 inferior al 1/2 del pedicelo. Botones florales elipsoidales. Flores 10–11 mm; cáliz 2.5–3 mm, ciatiforme, densamente pelúcido linear-punteado, glabro, excepto ciliolado en el margen, casi trunco; corola morada, guinda oscuro, esparcidamente con líneas y puntos translúcidos, la lámina del estandarte 9–10 mm de ancho, en ocasiones epunteada, adaxial y abaxialmente canescente serícea particularmente en la base; ovario 9-ovulado. Legumbre 6.5–9 cm de largo con 1 semilla, 11–15 cm con 2 o 3 semillas, 2.2–2.8 cm de ancho, elíptica a oblonga, indehiscente, aplanada, coriácea, las valvas lisas a la altura de las semillas, constricta entre las semillas sobre los márgenes, glabra, largamente atenuada en la base, margen vexilar alado, el ala hasta 2 mm de ancho, margen carinal nervado, el ápice obtuso, atenuado, en ocasiones brevemente rostrado; semillas 1 a 3 por fruto, ca. 13.4 × 7.3 mm, pardo-amarillentas. Plántulas con los cotiledones epigeos; eófilos opuestos, 1-foliolados, la 1ª hoja alterna 3-foliolada.

Distribución y hábitat. Esta especie es endémica de la Depresión Central de Chiapas; crece en altitudes entre 700 y 1000 m; la vegetación en que prospera es de selvas medianas subcaducifolias a subperennifolias, sobre suelos calizos.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus berriozabalensis* debe considerarse como: en peligro (EN), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie muy localizada, cuyo habitat está siendo rápidamente alterado.

Fenología. Esta especie florece de mediados de julio a la segunda quincena de septiembre; cuenta con frutos maduros en la segunda quincena de diciembre a finales de febrero.

Etimología. Faustino Miranda G. (1905–1964) fue el primero en colectar y reconocer a ésta como una nueva especie, también en ejemplares de herbario, él propuso el epíteto, el cual hace énfasis en lo extremadamente endémico de su distribución, en el área de Berriozábal.

Discusión. Esta especie es cercana a *Lonchocarpus longistylus* de la Península de Yucatán y vertiente del Golfo de México, ambas crecen en suelos calizos, pero en pisos altitudinales diferentes. Las diferencias entre estas especies son que en *L. berriozabalensis* la hojas están dispuestas muy cercanas unas de otras, dando la apariencia en ocasiones de ser casi opuestas y cuentan con hasta 13 folíolos (vs. hojas espaciadas, hasta 19-folioladas); folíolos de ápice corto acuminado a obtuso (vs. folíolos largamente acuminados a caudados); pedúnculos florales 1.5–3 mm de largo (vs. [2–]4–6[–9] mm de largo); pedicelos 2.5–4 mm de largo (vs. (3–)4–7 mm de largo); y la lamina del estandarte 9–10 mm de ancho (vs. 11–13 mm de ancho).

Esta especie fue sugerida como subespecie de *Lonchocarpus punctatus* por Sousa, en Palomino y

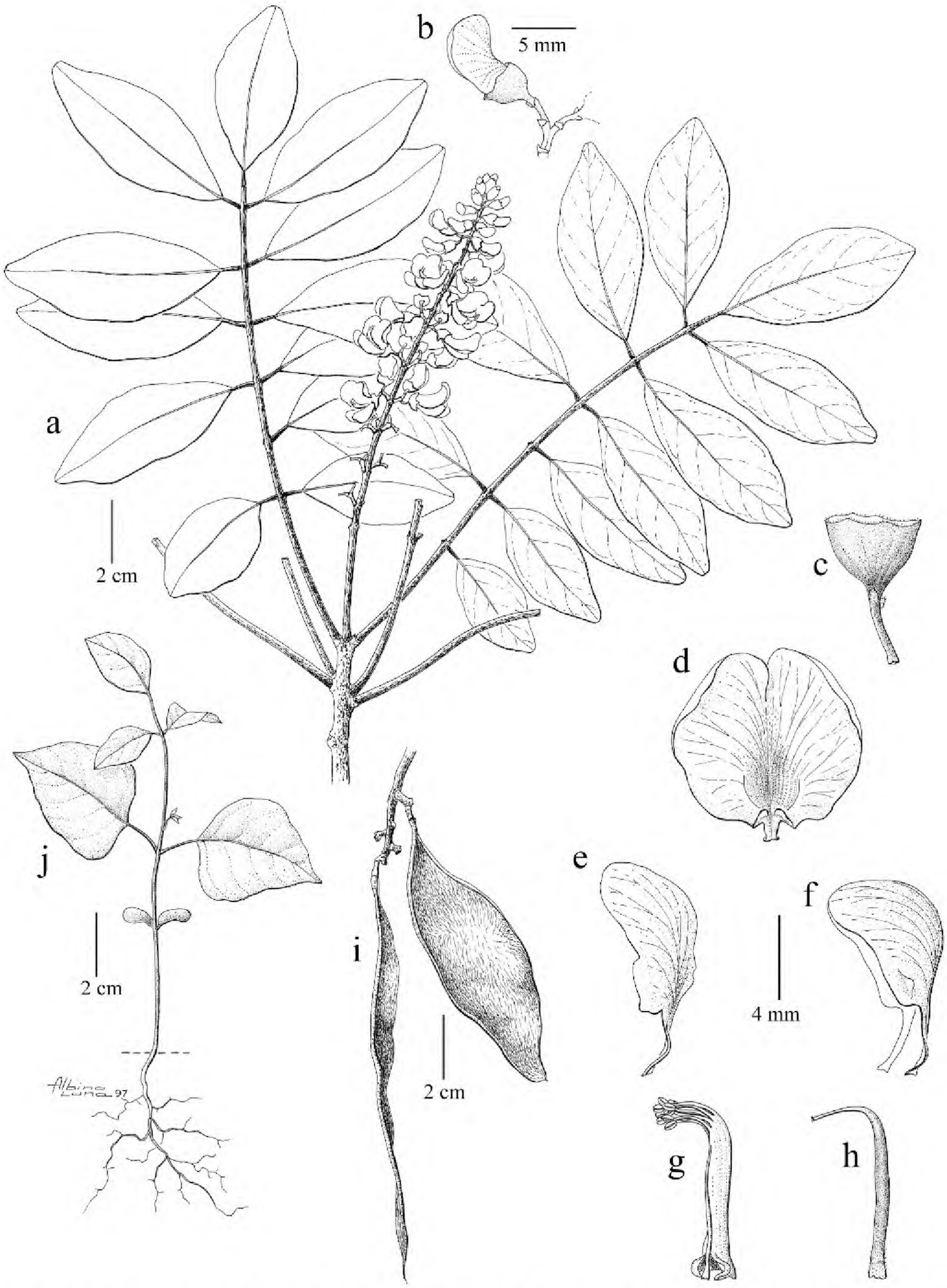

Figura 2. *Lonchocarpus berriozabalensis* Miranda ex M. Sousa. —A. Rama con hojas e inflorescencia. —B. Unidad biflora, mostrando brácteas y bractéolas. —C. Cáliz. —D. Estandarte mostrando callos y aurículas. —E. Ala. —F. Quilla. —G. Tubo estaminal. —H. Gineceo. —I. Infrutescencia. —J. Plántula. (A–H de *F. Miranda 7869*; I, J de *Sousa et al. 11634*.)

Sousa (2000), pero sin la intención de ser formalizada, ni validada.

Paratipos. MÉXICO. **Chiapas:** Mpio. Ocozocoautla, Finca El Suspiro, *F. Miranda 7657, 8569* (MEXU); NO Berriozábal, en el camino a El Suspiro, *Miranda 7869* (MEXU, US); a 1 km al NO del entronque Aeropuerto-Ocozocoautla, *A. Reyes G. y G. Urquijo 1000, 1247, 1254* (MEXU); Las Delicias, a 9 km al SO de Berriozábal, *M. Sousa, A. Delgado, O. Téllez y A. Solis M. 6677* (ENCB,

MEXU); Granja El Edén a 5 km al SO de Berriozábal, *M. Sousa, T. P. Ramamoorthy, L. Cortes y P. Basurto 11634* (MEXU); Fracc. Bosque de San Juan, a 4 km al E-SE de Ocozocoautla, *M. Sousa, E. Martínez S. y A. Reyes G. 13139* (MEXU); Mpio. San Fernando, a 2 km al SE de San Fernando, camino a Tuxtla [Gutiérrez], *E. Martínez S. y A. Reyes G. 22048* (MEXU).

4. **Lonchocarpus chiricanus** Pittier, Contr. U.S. Natl. Herb. 20: 63. 1917. TIPO: Panamá. Chiriquí: Isla Parida, 25 Feb. 1911, *H. Pittier 2817* (holotipo, US; isotipo, GH).

Se le ha colectado solamente en las islas y costas en el occidente de Panamá. Muy característica por sus flores grandes de ca. 19 mm de largo y frutos de gran tamaño y con textura subleñosa. Sus frutos muy posiblemente se dispersan por corrientes de agua.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus chiricanus* debe considerarse como: en peligro (EN), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie de endemismo estrecho, cuyo habitat insular costero esta sujeto a gran alteración.

Material representativo. PANAMÁ. **Bocas del Toro:** *H. von Wedel 1180* (MO, US). **Veraguas:** *G. W. Barclay 2804* (BM), *J. D. Dwyer 1561* (F, MO), *C. Galdames, B. Araúz y A. Castillo 3217, 3218, C. Galdames, L. Guillén, B. Araúz, C. Guerra, J. Cuadra y N. Bastillas 3639* (F, MA).

5. **Lonchocarpus cochleatus** Pittier, Contr. U.S. Natl. Herb. 20: 68. 1917. TIPO: México. Guerrero: El Calabazal, 18 Oct. 1898, *E. Langlassé 471* (holotipo, US; isotipos, GH, K, MEXU, P).

Lonchocarpus longipedicellatus Pittier, Contr. US. Natl. Herb. 20: 61. 1917. Syn. nov. TIPO: México. Chiapas: Jiquipilas, 31 May 1904, *E. A. Goldman 1030* (holotipo, US).

Lonchocarpus cochleatus y *L. longipedicellatus*, fueron publicados simultáneamente por Pittier (1917), pero se escogió el primero ya que, fue usado para la *Flora Novo-Galiciana* veáse Sousa (1983).

Especie nativa de la costa occidental de México, cuyo límite sur es la Depresión Central de Chiapas. Se caracteriza por sus pedicelos y pedúnculos florales delgados y largos, sus frutos anchos, leñosos frecuentemente cocleados y sus plántulas con cotiledones hipogeos y eófilos opuestos, 3-foliolados.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus cochleatus* debe considerarse como: casi amenazada (NT), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie de amplia distribución, cuyo habitat esta en constante proceso de alteración y destrucción, como en la Depresión Central de Chiapas, donde en la actualidad es muy escasa.

Material representativo. MÉXICO. **Chiapas:** *E. A. Goldman 1030* (US), *M. A. Magaña 2030* (MEXU). **Guerrero:** *R. Cruz D. 4253* (MEXU), *G. B. Hinton 10379* (K, MO, NA), *10384* (DS, F, MICH, MO), *N. Noriega A. 565* (MEXU), *J. C. Soto 9555* (MEXU). **Jalisco:** *S. H. Bullock 1400* (MEXU), *R. Ornelas U. y H. Luquín S. 1357* (ENCB, IBUG, MEXU), *A. Solis-Magallanes 118* (MEXU), *720* (ENCB, MEXU), *854, 1781*(MEXU), *4075* (ENCB, MEXU). **Michoacán:** *J. C. Soto N. 9521* (MEXU), *P. Tenorio L. 1549* (MEXU). **Nayarit:** *A. Bénitez P. 3221* (MEXU). **Oaxaca:** *M. Elorsa C. 910, 6897, 7319* (MEXU), *Tenorio y J. L. Linares 19800* (MEXU).

6. **Lonchocarpus cristatus** M. Sousa, sp. nov. TIPO: Honduras. Olancho: Campamento, Mpio. Campamento, bosque húmedo subtropical, 960 m, 8 may. 1984, *R. Ramos 115* (holotipo, TEFH; isotipo, MO). Figura 3.

Haec species *Lonchocarpo trifolio* Standley & L. O. Williams similis, sed ab eo petiolo costato (vs. canaliculato), foliis 5-foliolatis (vs. 3[5]-foliolatis) supra opacis (vs. nitidis), inflorescentiis erectis vel patentibus (vs. pendulis), pedunculis floralibus 4–7(–11) mm (vs. 3–6 mm) longis, pedicellis 6–9 mm (vs. 2–4 mm) longis et legumine suberoso valvis ad positionem seminis cristatis ac tuberculo suberoso prominente ornatis differt.

Arbolitos 3–4 m; corteza sin fluido resinoso rojizo al corte; ramas esparcidamente canescente pubescentes, pronto glabras. Hojas con arreglo dístico en el tallo; estípulas ca. 1.5 × 2 mm, oblatas, anchamente elípticas, pronto caducas; pecíolo 3–5.5 cm, ligeramente acostillado; hojas 5-folioladas; folíolos (3–)5–10 × (2.2–)3–5.5 cm, elípticos a anchamente elípticos, subcoriáceos, en ocasiones algo cocleados, pelúcido punteados, algo discoloros, la base cuneada a redondeada, los márgenes rectos a ligeramente ondulados, el ápice acuminado a corto acuminado, el haz opaco, glabro, el envés esparcidamente canescente seríceo, papiloso; nervaduras primaria y secundarias ligeramente realzadas en el envés, nervaduras secundarias 7 a 12. Inflorescencias (3.5–)5–9 cm, erectas a patentes, paucifloras, pedúnculos 1.2–4 cm; floración tardía; pedúnculos florales 4–7(–11) mm, delgados; pedicelos 6–9 mm; bractéolas 0.8–0.9 mm, ovadas, escariosas, opuestas, subopuestas a en ocasiones alternas, del 1/3 inferior al 1/2 del pedicelo. Botones florales elipsoidales. Flores 13–14 mm; cáliz ca. 4 mm, ciatiforme, densamente pelúcido linear-punteado, casi glabro, excepto ciliolado en el margen, casi trunco; corola con abundantes líneas y puntos translúcidos, la lámina del estandarte 13.5–15 mm de ancho, orbicular a oblata, ligeramente cóncava, casi glabra; ovario 6- a 7-ovulado. Legumbre 4.5–5.5 × 2.5–3.5 × 1.2–1.3 cm, elíptica, indehiscente, suberosa, las valvas con crestas y tubérculos prominentes suberosos a la altura de la

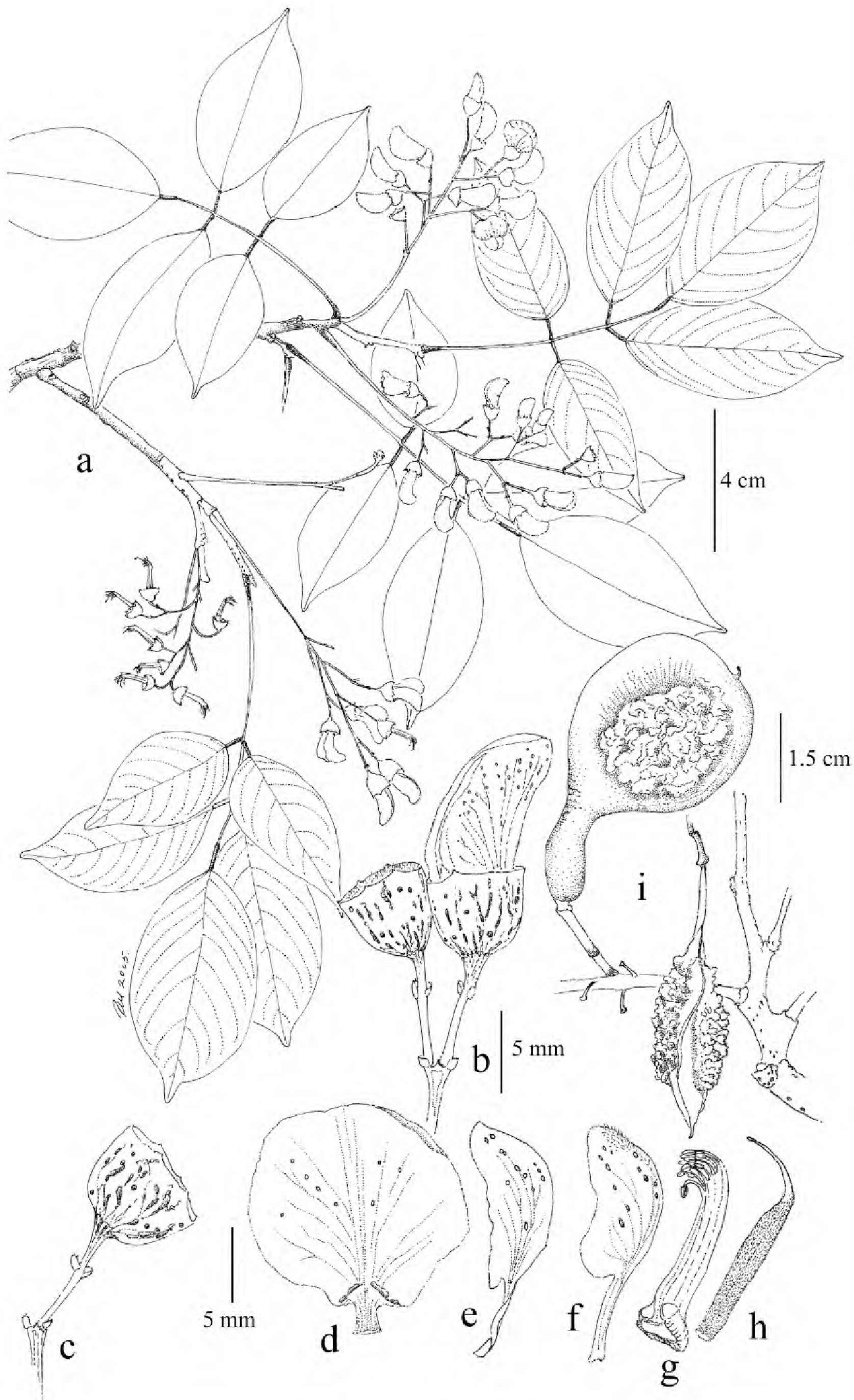

Figura 3. *Lonchocarpus cristatus* M. Sousa. —A. Rama con hojas e inflorescencias. —B. Unidad biflora, mostrando brácteas, bractéolas y flores. —C. Cáliz, mostrando lo pelucido linear-punteado. —D. Estandarte. —E. Ala. —F. Quilla. —G. Tubo estaminal. —H. Gineceo. La escala de B es igual a las escalas de C–H. —I. Legumbres, mostrando valvas con crestas y tubérculos. (A–H de *Keyser 1419*; I del tipo *Ramos 115*).

semilla, casi glabra excepto esparcidamente canescente serícea en el ápice, largamente estipitada, márgenes angostamente aquillados, el ápice rostrado; semillas (inmaduras) 1 por fruto.

Distribución y hábitat. Esta especie es endémica del centro de Honduras, en áreas montañosas de los departamentos de Francisco Morazán y Olancho; forma parte de las selvas bajas cáducifolias intermontanas; crece en altitudes entre 960 y 1100 m.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus cristatus* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); endémica restringida, cuyo habitat esta bajo presión de alteración.

Fenología. La floración es en la primera quincena de mayo y fructifica en septiembre y octubre.

Etimología. El epíteto se refiere a las valvas del fruto que cuentan con crestas y tubérculos suberosos.

Discusión. Lonchocarpus cristatus está emparentada con *L. trifolius*, de la cual se contrasta en la diagnosis. Es notable por las valvas de su legumbre, con crestas y tubérculos suberosos, carácter único en la sect. *Punctati*. También ésta se relaciona con *L. linaresii* M. Sousa, para diferencias véase a ésta.

Paratipos. HONDURAS. **Francisco Morazán:** cerca aldea de Mateo, 12 km al SO de Tegucigalpa, *A. R. Aldino 165* (TEFH); Cerro Uyuca, a 20 km E de Tegucigalpa, *C. Bendeck E. 43* (MO); Col. 15 de Septiembre, Comayagüela, *S. C. Cerna 180* (MO, TEFH); Mateo, *R. Gómez P. 241* (MEXU, MO); Col. 15 de Septiembre, Tegucigalpa, *I. R. Guerra C. 177* (MO); El Picacho, arriba de Tegucigalpa, *L. Paray s.n.* (EAP); alrededores de Mateo, 12 km al SO de Tegucigalpa, *R. M. Rivas 178* (MEXU, MO). **La Paz:** Estanzuela, Marcala, a 12 km N de Marcala, *R. Keyser 1419* (EAP). **Olancho:** Campamento, Mpio. Campamento, *R. Ramos 151* (TEFH).

7. Lonchocarpus linaresii M. Sousa, sp. nov. TIPO: Honduras. Francisco Morazán: a 20 km al SO de El Zamorano, Mpio. Maraita, 13°51′40″N, 87°06′27″O, selva mediana subcaducifolia, arbusto 3 m alto, flor morada, 668 m, 20 jul. 2003, *E. Martínez S., D. Álvarez y J. L. Linares 36279* (holotipo, MEXU; isotipos, BM, EAP, K, MEXU, MO). Figura 4.

Haec species *Lonchocarpo trifolio* Standley & L. O. Williams similis, sed ab eo petiolo costato (vs. canaliculato), foliolis supra opacis (vs. nitidis), inflorescentiis erectis vel patentibus (vs. pendulis), floribus 14–16 mm (vs. 12–14 mm) longis et legumine margine vexillari alato (vs. sulcato) differt.

Arbustos a arbolitos 2–4 m; corteza fisurada, suberosa, sin fluido resinoso rojizo al corte; ramas canescente pubescentes, pronto glabras. Hojas con arreglo dístico en el tallo; estípulas 0.9–1.1 × 1–1.2 mm, ligulares, anchamente triangulares a anchamente reniformes, pronto caducas; pecíolo 1.5–3.6 cm acostillado y ligeramente canaliculado; hojas (3)5-folioladas; folíolos (3–)5–8(–10) × (2–)2.5–4.5(–5.7) cm, elípticos, ovados a casi orbiculares, subcoriáceos, pelúcido punteados, ligeramente discoloros, la base oblicua a redondeada, los márgenes rectos, el ápice corto acuminado a apiculado, en ocasiones redondeado, el haz opaco y casi glabro, el envés moderada a esparcidamente canescente velutino a pubescente, más densamente sobre las nervaduras, escasamente papiloso; nervaduras primaria y secundarias ligeramente realzadas en el envés, nervaduras secundarias 7 a 11. Inflorescencias 6.5–18 cm, erectas a patentes, paucifloras; pedúnculos 3–6 cm, floración tardía; pedúnculos florales 2.3–4 mm, delgados; pedicelos 2.5–5 mm; bractéolas 0.6–0.7 mm, ovadas, escariosas, opuestas a subopuestas, del 1/3 inferior al 1/3 superior del pedicelo. Botones florales elipsoidales a subesféricos. Flores 14–16 mm; cáliz 3.5–4.5 mm, ciatiforme, densamente pelúcido linear-punteado, casi glabro, excepto ciliolado en el margen, casi trunco; corola morada a casi azul, con abundantes líneas y puntos translúcidos, la lámina del estandarte 12–13 mm de ancho, orbicular a oblata, ligeramente cóncava, canescente serícea sobre las nervaduras, más densamente en la base; ovario 6(8)-ovulado. Legumbre 4.5–5 cm de largo con 1 semilla, 5.5–6.5 cm con 2 semillas, 6–10 cm con 4 semillas, 1.7–2.1 cm de ancho, elíptica a oblonga, indehiscente, aplanada, coriácea, resinosa, las valvas lisas a la altura de las semillas, constricta entre las semillas sobre los márgenes, casi glabra, largamente estipitada, margen vexilar alado, el ala hasta 1 mm de ancho, margen carinal angostamente aquillado, el ápice rostrado; semillas (inmaduras) 1- a 2(4) por fruto. Plántulas con los cotiledones epigeos; eófilos opuestos, 1-foliolados, la 1ª hoja alterna 3-foliolada.

Distribución y hábitat. Esta especie es sólo conocida en Honduras en los departamentos de El Paraíso y Francisco Morazán; crece en selvas bajas a medianas, caducifolias a subcaducifolias, en ocasiones como elemento de sabanas con pinares, frecuente como riparia; la elevación entre 400 a 800 m.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus linaresii* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie endémica, cuyo habitat esta rápidamente siendo alterado y destruido.

Fenología. La floración se presenta de finales de julio a principios de noviembre; fructifica de principios de noviembre a finales de diciembre.

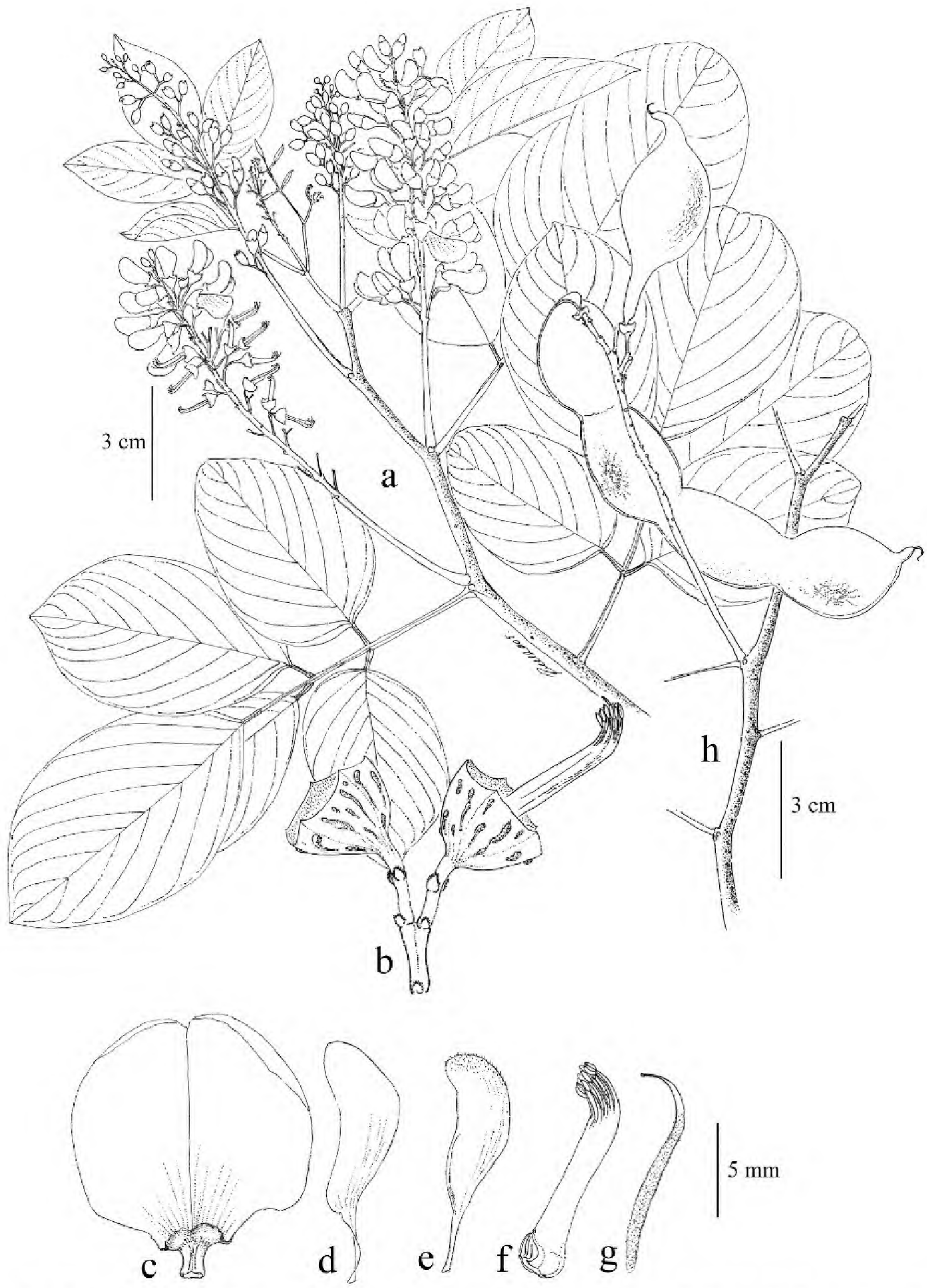

Figura 4. *Lonchocarpus linaresii* M. Sousa. —A. Rama con hojas e inflorescencias. —B. Unidad biflora mostrando brácteas, bractéolas y cálices. —C. Estandarte. —D. Ala. —E. Quilla. —F. Tubo estaminal. —G. Gineceo. —H. Infrutescencia. (A del tipo *Martínez S. et al. 36279*; B–G de *Martínez S. et al. 36278*; H de *Molina R. 13209*.)

Etimología. Esta especie se dedica al destacado botánico salvadoreño José Ledis Linares (1966–), estudioso de la flora de Centroamérica, particularmente de sus árboles, leguminosas y orquídeas de El Salvador y Honduras.

Discusión. Esta especie es cercana a *Lonchocarpus trifolius*, de la que se compara en la diagnosis, también su hábitat difiere ya que *L. trifolius* crece en un piso altitudinal mayor, en tipos de vegetación mas templados. Esta especie también es próxima a *L. cristatus*, pero difiere de ella, por sus pedicelos 2.5–5 mm de largo (vs. 6–9 mm de largo); pedúnculos florales 2.3–4 mm de largo (vs. 4–7 mm de largo); flores 14–16 mm de largo (vs. 13–14 mm de largo); legumbres 1.7–2.1 cm de ancho, coriáceas (vs. 2.5–3.5 cm de ancho, subleñosas), y las valvas de las

legumbres lisas a rugosas (vs. las valvas crestadas y tuberculadas).

Paratipos. HONDURAS. **Francisco Morazán:** Las Moras, *Anónimo s.n.* (EAP); a 20 km SO de El Zamorano, *E. Martínez S. 36278* (EAP, MEXU). **Paraíso:** Las Pintadas, 4–5 km al N de Oropolí, *S. Duery y J. Linares 176, 209* (EAP, MEXU); Quebrada Grande, a 1.9–2 km N de Morocelí, Mpio. Morocelí, nov. 2002, *J. Linares s.n., 6099, 6257, 6846* (EAP, MEXU); El Rodeo, entre Yuscarán y Oropolí, Mpio. Yuscarán, *J. Linares 4116* (EAP, MEXU); camino a El Plan, E de Morocelí, Mpio. Morocelí, *J. Linares, F. Escobedo y B. Knoblauch 5398* (MEXU); a 21 km al NE de El Zamorano, camino a Morocelí–Plan Quebrada, *E. Martínez S., D. Álvarez y J. Linares 36201* (EAP, MEXU); La Quebrada, entre Yuscarán y Oropolí, *A. Molina R. 8579* (EAP, F); Río Oreolí, entre Oreolí y Oropolí, *A. Molina R. 13212* (EAP, F); Colinas y Quebrada Las Lajas, E de Yuscarán, *A. Molina R. 13209* (EAP, F, NY); Quebrada El Muro, *P. C. Standley 29265* (DS, EAP, F, US); Quebrada, El Muro, betw. Las Mesas ca. Yuscarán, *L. O. Williams, A. Molina R., T. P. Willliams y A. de Molina 42883* (BM, EAP, F, MICH).

8. Lonchocarpus longistylus Pittier, Contr. U.S. Natl. Herb. 20: 62. 1917. TIPO: México. Yucatán: Izamal, s.d., *G. F. Gaumer 904* (holotipo, F; isotipos, A, K, MO, P, US).

Robinia latifolia Miller, Gard. Dict. ed. VIII No. 9. 1768, non *Robinia latifolia* Poiret, Encycl. 6(1): 224. 1804. TIPO: México. Campeche: *W. Houstoun s.n.* (holotipo, BM 1730-31).

Cyanobotrys mexicana Zuccarini, p.p. Abr. Math.-Phys Cl. Königl. Bayer Akad. Wiss. 4(2): 30. 1845. Syn. nov. *Muellera mexicana* (Zuccarini) Bentham, J. Linn. Soc., Bot. 4 (Suppl.): 117. 1860. *Coublandia mexicana* (Zuccarini) Baillon, Adansonia 19: 238. 1870. TIPO: México: "in imperii mexicani regionibus calidioribus", *W. F. Karwinsky 175* (lectotipo, aquí designado [material con hojas, inflorescencias y flores], M; duplicado, LE).

El binomio más antiguo es *Robinia latifolia* Miller, non *R. latifolia* Poiret (Poiret, 1804), el cual no se puede usar de basónimo, ya que el epíteto *latifolius* fue empleado por Kunth ex A. L. P. P. de Candolle (1825) para otra especie de *Lonchocarpus*.

Con respecto a *Cyanobotrys mexicana* Zuccarini, de nuevo no se puede emplear para combinación a *Lonchocarpus*, ya que, existe *L. mexicanus* Pittier (Pittier, 1917). *Cyanobotrys* Zuccarini es un género basado en elementos heterogéneos, por un lado las hojas, inflorescencias y flores pertenecen a *Lonchocarpus* y por otro lado, los frutos, las semillas y plántula son de *Calia secundiflora* (Gómez-Ortega) Yakovlev. Bentham (1860) sospechó que se trataba de dos géneros diferentes, pero sin embargo, lo transfirió al género *Muellera*, debido a que erróneamente pensó que Zuccarini (1845), obtuvo el material en flor a partir de germinar las semillas de los frutos (de *Calia* Berlandier). Debido a que el nombre genérico se refiere a las flores, ubicamos al género *Cyanobotrys* como *Lonchocarpus* y no bajo *Calia*.

Distribución. Sobre su distribución en Chiapas, Miranda (1952) anota que esta especie se encuentra con frecuencia cultivada en los caribales abandonados por los lacandones que emplean su corteza para una bebida fermentada. El material de Honduras es muy probable que sea introducido.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus longistylus* debe considerarse como: casi amenazada (NT), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie de amplia distribución, con presión de destrucción de su habitat, pero que en ciertas áreas es favorecida al recibir protección, por sus cualidades de uso.

Nombre vulgar. Balche (nombre Maya).

Discusión. *Lonchocarpus longistylus* es similar a *L. berriozabalensis*, sus diferencias se hacen notar en esta última, también se distingue por sus hojas glabras, con folíolos numerosos (11 a 15[19]) y ápice acuminado a subcaudado.

Esta especie fue sugerida como subespecie de *Lonchocarpus punctatus* por Sousa, en Palomino y Sousa (2000), pero sin la intención de ser formalizada, ni validada.

Material representativo. BELICE. **Orange Walk:** *Ch. Lincoln 6* (MO). GUATEMALA. **Petén:** *C. L. Lundell 15347* (LL, MEXU), *R. Tún Ortiz 351* (BM, NY, US), *436* (ENCB, MO, NY). HONDURAS. **Francisco Morazán:** *C. Bencleck E. 86* (MO), *C. Torres F. 36* (TEFH). MÉXICO. **Campeche:** *G. Becab W. 146* (MEXU), *E. Martínez S. 28625, 29789* (MEXU). **Chiapas:** *G. Aguilar M. 3251, 9296* (MEXU), *E. Martínez S. 8259* (MEXU). **Puebla:** *P. Basurto y G. Durán 183, 253, 528* (MEXU). **Quintana Roo:** *E. Cabrera C. 13129* (MEXU), *L. A. Pérez y C. H. Ramos 1605* (MEXU), *O. Téllez et al. 3812* (MEXU). **Veracruz:** *I. Calzada 1727* (MEXU), *M. Sousa 4077, 4273* (MEXU). **Yucatán:** *E. Cabrera 10374* (MEXU), *P. Simá et al. 2252* (CICY, MEXU), *E. Ucán 4260* (CICY, MEXU).

9. Lonchocarpus michelianus Pittier, Contr. U.S. Natl. Herb. 20: 61. 1917. TIPO: Guatemala. Santa Rosa: Naranjo, May 1893, *Heyde y Lux ex J. D. Smith 4468* (holotipo, US; isotipos, GH, K, MO, NY).

Especie endémica del área volcánica del sur de Guatemala de Sololá a Santa Rosa y en el oeste de El Salvador en Ahuachapán y Santa Ana; en altitudes entre 1400 a 1740 m.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus michelianus* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie

endémica, cuyo habitat esta siendo alterado y destruido.

Material representativo. EL SALVADOR. **Ahuachapán:** *E. Sandoval 331* (B), *1132* (B, MO). **Santa Ana:** *P. H. Allen 6854* (EAP, F, NY), *J. Linares 4555 bis* (MEXU). GUATEMALA. **Sololá:** *C. E. Hughes 1477* (EAP, MEXU, NY).

10. Lonchocarpus trifolius Standley & L. O. Williams, Ceiba 1: 144. 1950. TIPO: Honduras. Francisco Morazán: a lo largo del Río Santa Clara, 6 ago. 1949, *L. O. Williams y A. Molina R. 15859* (holotipo, US; isotipos, BM, F, GH, MO, WIS).

Especie sólo conocida del Departamento de Francisco Morazán en Honduras; muy característica por contar sus hojas generalmente con tres folíolos, el haz de las hojas brillante y las inflorescencias péndulas.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus trifolius* debe considerarse como: en peligro (EN), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie de endemismo estrecho, muy poco colectada, cuyo habitat esta siendo destruido.

Material representativo. HONDURAS. **Francisco Morazán:** *A. Carrasco 1* (EAP), *J. L. Linares y F. Hubbard 3377* (EAP, MEXU), *J. L. Linares 5572* (MEXU), *F. G. Meyer 9934* (MO), *P. Standley 26627* (DS, EAP, F, GH, MO, US, WIS).

11. Lonchocarpus vallicola (Standley & F. J. Hermann) M. Sousa, comb. nov. Basónimo: *Terua vallicola* Standley & F. J. Hermann, J. Wash. Acad. Sci. 39: 306. 1949. TIPO: Honduras. El Paraíso: in barranco, along Río Yeguare, near Las Casitas, 900 m, 4 Dec. 1946, *L. O. Williams y A. Molina R. 11072* (holotipo, F; isotipo, GH). Figura 5.

Arbustos a arbolitos 2–4(–6) m; corteza sin fluido resinoso rojizo al corte; ramas glabras. Hojas con arreglo dístico en el tallo; estípulas 1–1.3 × 1–1.1 mm, anchamente ovadas, pronto caducas; pecíolo 1.5–3 cm, marcadamente canaliculado; hojas 5-folioladas, folíolos (1.7–)3–10 × (0.8–)2–3.8(–5) cm, elípticos a anchamente elípticos, coriáceos, diminutamente translúcido punteados, ligeramente discoloros, la base cuneada a en ocasiones redondeada, los márgenes en las hojas maduras revolutos, el ápice obtuso a redondeado en ocasiones emarginado, el haz brillante a opaco, glabro, el envés glabro, pero papiloso, con las nervaduras rojizas; nervaduras primaria y secundarias ligeramente realzadas en el envés, nervaduras secundarias ca. 4 pares. Inflorescencias 3.5–10 cm, erectas a patentes, paucifloras, pedúnculo 1.5–4 cm; floración tardía; pedúnculos florales (2–)3–7 mm, delgados; pedicelos 2–5(–7.5) mm; bractéolas 0.4–0.7 mm, ovadas, escariosas, opuestas, del 1/2 al 1/3 superior del pedicelo. Botones florales elipsoidales; flores 12–14 mm; cáliz 3–4 mm, ciatiforme, densamente pelúcido linear y punteado, esparcidamente canescente seríceo a glabro, ciliolado en el margen, ligeramente lobulado, el lóbulo carinal más prominente; corola rojo-púrpura oscuro con abundantes líneas y puntos traslúcidos, la lámina del estandarte 9–12 mm de ancho, casi orbicular, ligeramente cóncava, glabra; ovario 8- a 9-ovulado. Legumbre 4–8 × 1.5–2.5, elíptica, oblonga a linear-oblonga algo falcada, dehiscente sólo en el margen vexilar, aplanada, coriácea, las valvas lisas a la altura de las semillas, sin o con constricciones entre las semillas, glabra, largamente estipitada, margen vexilar nervado, margen carinal angostamente aquillado, el ápice largamente rostrado; semillas 1 a 4 por fruto, 10–12 × 6–8 mm, color castaño a castaño oscuro.

El género *Terua* y su especie *T. vallicola* fueron descritos por Standley y Hermann en Hermann (1949); el único carácter que los autores apuntan para definir a este género es la dehiscencia de la legumbre, por lo que, lo colocaron en la tribu Galegeae y no en la Dalbergieae. Sin embargo dudan de su ubicación taxonómica y refieren varios caracteres florales y vegetativos que "mimetizan a *Lonchocarpus*". La dehiscencia de la legumbre en *Lonchocarpus* ya ha aparecido en varias ocasiones como en las sect. *Eriophylli* Bentham (Bentham, 1860) y sect. *Willardia* (Rose) M. Sousa (Sousa, 1992); y en la sect. *Punctati* en otras tres especies (*L. caudatus*, *L. galeottianus* Harms y *L. angusticarpus*). En casi todos los casos la dehíscencia del fruto en *Lonchocarpus* se presenta solamente en el margen vexilar.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus vallicola* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie restringida a Honduras, pero que se le ha colectado recientemente; su habitat está siendo alterado.

Material estudiado. HONDURAS. **Copán:** Cordillera Gallinero, betw. San Jerónimo & Concepción, *A. Molina R. et al. 33636* (EAP, MEXU). **Francisco Morazán:** Quebrada El Gallo, Mpio. San Antonio de Oriente, *J. Araque 993* (EAP, MEXU); E del Cementerio de San Antonio Oriente, Mpio. San Antonio de Oriente, *J. L. Linares 6292* (EAP, MEXU); Jicarito, along jct. of El Gallo and Jicarito creeks, *A. Molina R. 145* (F, GH); San Antonio, *A. Molina R. 336* (F, GH, MO); quebrada seca, betw. El Zamorano & San Antonio de Occidente, *P. C. Standley 11745* (BM, F, GH); above El Jicarito, rd. to San Antonio de Oriente, *P. C. Standley 22564*, *26423* (GH, MO). **Paraíso:** a 11 km al E de El Zamorano, camino a Dahlí, *E. Martínez S. 12528* (EAP, MEXU); Mt.

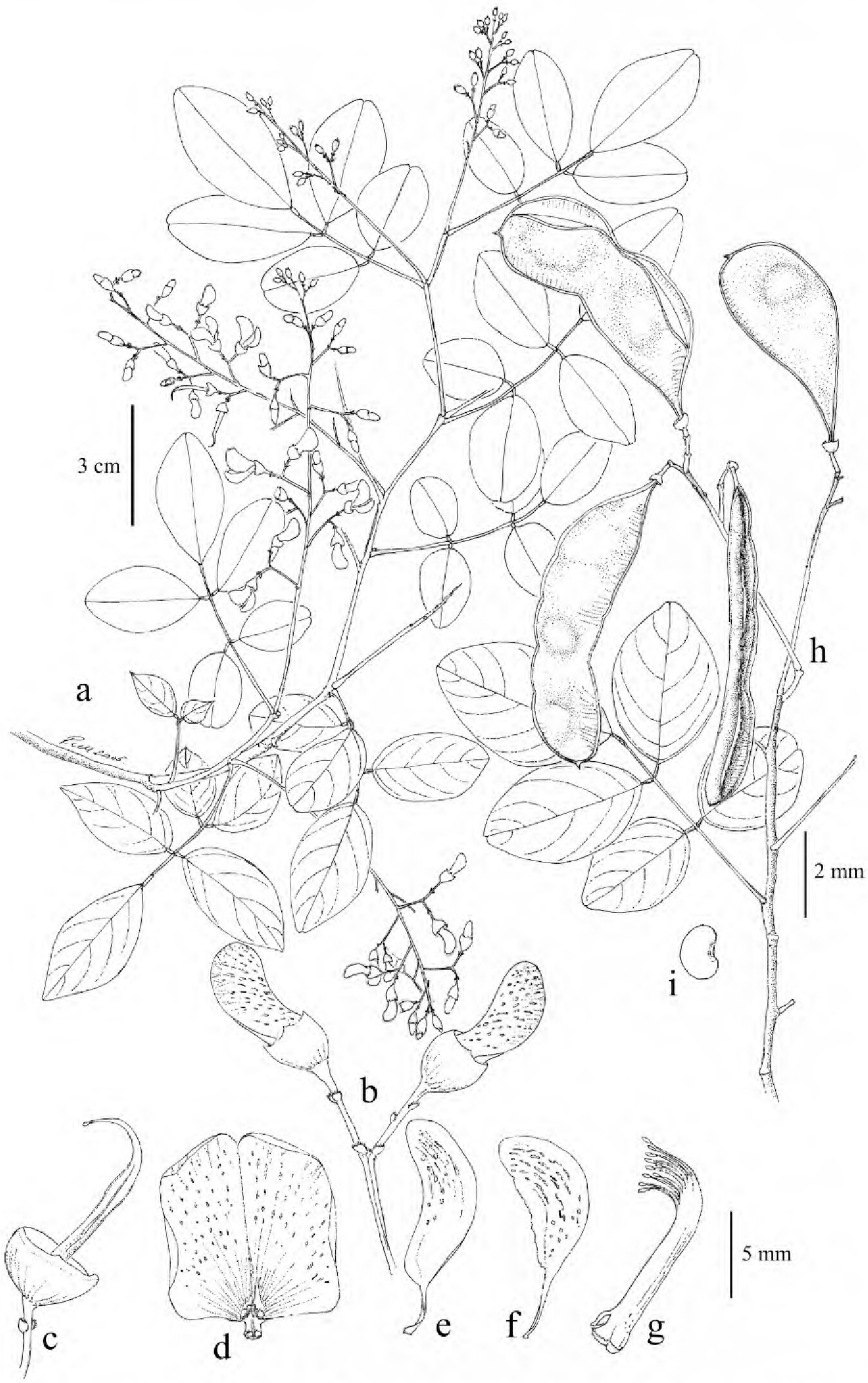

Figura 5. *Lonchocarpus vallicola* (Standley & F. J. Hermann) M. Sousa. —A. Rama con hojas e inflorescencias. —B. Unidad biflora, mostrando brácteas, bractéolas y botones florales. —C. Cáliz y gineceo. —D. Estandarte. —E. Ala. —F. Quilla. —G. Tubo estaminal. —H. Rama con infrutescencias y frutos. —I. Semilla. (A–G de *Molina R. 14454*; H de *Standley et al. 590*; I de *Williams y Molina R. 11532*.)

Yuscarán, *A. Molina R. 602* (F, GH); drainage of Río Yeguare, *A. Molina R. 4116* (GH); Vegas del Río Mata Indio entre San Francisco y Lizapa, *A. Molina R. 14454* (EAP); Río Leotuna, Galeras Guinope, Mpio. Guinope, *M. Sousa et al. 13282* (EAP, MEXU); Las Casitas, *P. Standley et al. 590* (GH); vic. of Galeras, *P. Standley et al. 1991* (GH); along Río Yaguare, *L. O. Williams y A. Molina R. 11532* (F, GH), *13414* (F, GH, MO).

12. Lonchocarpus vittatus M. Sousa, sp. nov. TIPO: México. Veracruz: Puente San Miguel, entre Orizaba y Fortín, ripario, 1000 m, 23 ago. 1967, *M. Sousa 3160* (holotipo, MEXU; isotipos, BM, MEXU, MO). Figura 6.

Haec species a congeneris mesoamerocanis ad *Lonchocarpum* sect. *Punctatos* pertinentibus foliolis lanceolato-ellipticis infra trichomatibus canescentibus sparse minuteque sericeis, inflorescentia longa, legumine indehiscente cartaceo margine vexillari alato atque seminibus castaneis vittis maculisque irregularibus atrobrunneis notatis distinguitur.

Árboles (5–)8–20 m; corteza sin fluido resinoso rojizo al corte; ramas casi glabras. Hojas con arreglo dístico en el tallo; estípulas ca. 1.2 × 1 mm, anchamente triangulares, pronto caducas; pecíolo 2.7–5 cm, canaliculado y acostillado; hojas (9)11- a 13(15)-folioladas; folíolos 4–7 × 2.3–2.8 cm, elíptico-lanceolados, cartáceos a subcoriáceos, pelúcido punteados, ligeramente discoloros, la base ligeramente oblicua, cuneada a redondeada, los márgenes ligeramente ondulados, el ápice acuminado a subcaudado, el haz ligeramente brillante, casi glabro, el envés esparcida y diminutamente canescente seríceo, papiloso; nervaduras primaria y secundarias ligeramente realzadas en el envés, nervaduras secundarias hasta 5 pares. Inflorescencias (5–)8–16(–21) cm, erectas, densifloras, particularmente en el 1/2 al ápice, pedunculadas, los pedúnculos 2.5–5.5 cm; floración tardía; pedúnculos florales 1.3–4 mm, delgados; pedicelos 3.5–5 mm, delgados; bractéolas 0.6–0.8 mm, oblongas a ovadas, escariosas, opuestas a subopuestas, generalmente en el 1/3 superior del pedicelo. Botones florales angostamente elipsoidales. Flores (9–)10–12(–13) mm; cáliz 3–3.5 mm, ciatiforme, densamente pelúcido linear-punteado, casi glabro a muy esparcidamente pardo-amarillento seríceo, ciliolado en el margen, ligeramente lobulado, el lóbulo carinal más prominente; corola lila a rosada con esparcidas líneas y puntos translúcidos, la lámina del estandarte 9–12 mm de ancho, orbicular, ligeramente cóncava, casi glabra a esparcidamente canescente serícea, sobre las nervaduras centrales más densamente en la base adaxialmente, esparcidamente en la base abaxialmente; ovario 7- a 8-ovulado. Legumbre 6–7 cm de largo cuando 1 semilla, 9–10.5 cm cuando 2 a 3 semillas, 2.4–2.7 cm de ancho, elíptica a oblonga, indehiscente, aplanada, cartácea, algo resinosa, marcadamente constricta entre las semillas sobre los márgenes, las valvas lisas, glabras, atenuadas en la base, margen vexilar alado, el ala hasta 1.3 mm de ancho, el margen carinal angostamente aquillado, el ápice rostrado, en ocasiones obtuso; semillas 1 a 3(5) por fruto, 1.4–1.7 × 0.8–0.9 mm, color castaño con bandas y manchas irregulares de castaño más oscuro. Plántulas con los cotiledones epigeos; eófilos opuestos, 1-foliolados, la 1ª hoja alterna 3-foliolada.

Distribución y hábitat. Esta especie se encuentra en las estribaciones del Eje Volcánico Transversal, hacia la vertiente del Golfo de México, en la Sierra Madre de Chiapas, y en la Cordillera Montecillos en Honduras y El Salvador; en altitudes entre 740 y 1400 m; crece en bosques caducifolios con lauraceas, en bosques mesófilos de montaña, pinares y encinares, a la orilla de corrientes de agua; sobre suelos de origen volcánico, sedimentario y metamórfico.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus vittatus* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie de amplia distribución, pero habita en vegetación que está fuertemente sujeta a alteración y destrucción.

Fenología. Esta especie florece en México de mediados de agosto a finales de septiembre, en El Salvador y Honduras de fines de abril principios de junio, fructifica a principios de marzo.

Etimología. El epíteto hace referencia a las bandas irregulares de tono oscuro en la testa de sus semillas.

Nombre vulgar. Frijolillo (*M. Sousa 4439*, MEXU, Veracruz).

Discusión. Especie característica por sus folíolos lanceolado-elípticos, con el envés esparcidamente diminutamente canescente seríceo; la inflorescencia larga; la legumbre indehiscente, cartácea, el margen vexilar alado; semillas de color castaño con bandas y manchas irregulares de tono más oscuro; caracteres que la distinguen de las otras especies de la sección en Mesoamérica.

Esta especie fue sugerida como subespecie de *Lonchocarpus punctatus* por Sousa, en Palomino y Sousa (2000), pero sin la intención de ser formalizada, ni validada.

Paratipos. EL SALVADOR. **Chalatenango:** ca. de La Cárcava La Zompopera, entre La Zompopera y el cerro Miramundo, Mpio. La Palma, *J. Linares y D. Angulo 5983* (MEXU). HONDURAS. **Comayagua:** a 18 km al N de Otoro, camino La Esperanza–Siguatepec, Mpio. Jesús de Otoro, *E. Martínez S. y O. Téllez 12817* (EAP, MEXU). MÉXICO. **Chiapas:** Mpio. Albino Corzo, slopes of Río Cuxtepec, below Finca Cuxtepec, *D. E. Breedlove 52112* (MEXU); Libertad, El Pajal, a 12 km al SE Jaltenango (Angel Albino Corzo), Río El Paso afluente Escaleras, *M. Sousa, E. Martínez S. y A. Reyes G. 13199* (MEXU); a 3 km al NO de San Nicolás, *M. Sousa, E. Martínez S. y A. Reyes G. 13206* (MEXU). **Veracruz:** Coapichapa, Puente San Miguel, *M. Sousa 3223* (MEXU), *3224* (GH, MEXU, MO), *3370* (A, MEXU); a 1.5 km al E de Peñuela, al O de la desviación a Potrero, *M. Sousa 4429* (MEXU, NY).

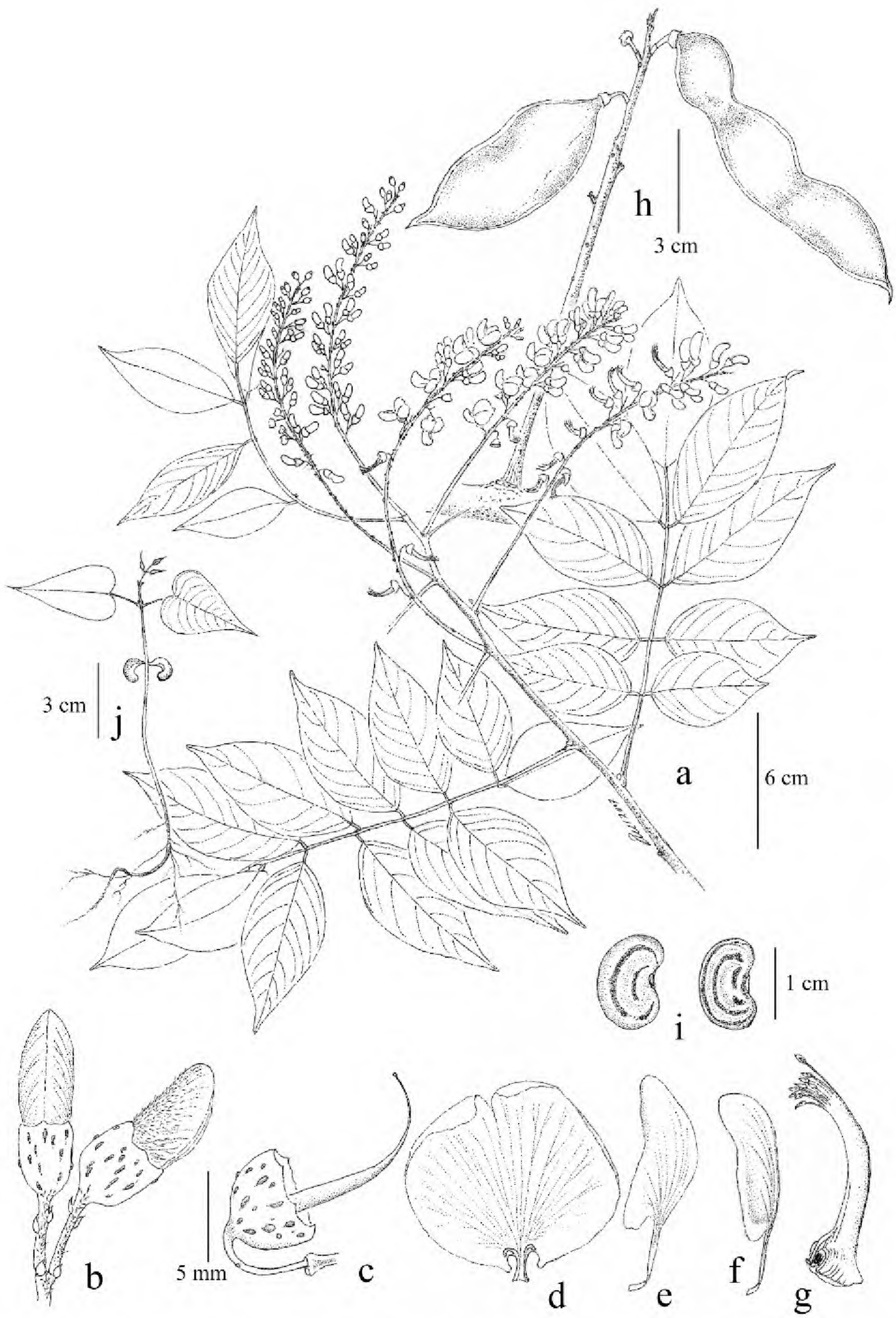

Figura 6. *Lonchocarpus vittatus* M. Sousa. —A. Rama con hojas e inflorescencias. —B. Unidad biflora, mostrando brácteas y bractéolas alternas. —C. Cáliz y gineceo. —D. Estandarte. —E. Ala. —F. Quilla. —G. Tubo estaminal. —H. Infrutescencia con frutos. —I. Semillas mostrando bandas y manchas irregulares oscuras. —J. Plántula. (A–G de *Breedlove 52112*; H de *Sousa et al. 13206*; I, J de *Sousa et al. 13199*.)

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de *Novon*, la cual realizo un minucioso trabajo; a los tres revisores, uno anónimo, a Ana Maria Azevedo-Tozzi y Roy Gereau, quienes proporcionaron sugerencias que mejoraron al manuscrito; y a los curadores de los siguientes herbarios por facilitar el material de estudio: A, B, BM, BR, CAS, CICY, CR, DS, EAP, Ecosur (San Cristóbal de las Casas, Chiapas), ENCB, F, G, GH, HAL, IBUG, INIF, K, LE, LL, M, MA, MEXU, MICH, MO, NA, NY, OAX, P, TEFH, UC, US, USCG y XAL.

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Actinocephalus koernickeanus, a New Species of Eriocaulaceae from Minas Gerais, Brazil

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Abstract. We describe and illustrate the new species *Actinocephalus koernickeanus* Trovó & F. N. Costa (Eriocaulaceae, Paepalanthoideae) from the Espinhaço Range in Minas Gerais, Brazil, and compare it with the morphologically similar species, *Paepalanthus actinocephaloides* Silveira and *P. barbiger* Silveira, both from Espinhaço Range.

Resumo. Descrevemos e ilustramos a nova espécie *Actinocephalus koernickeanus* Trovó & F. N. Costa (Eriocaulaceae, Paepalanthoideae) ocorrente na Cadeia do Espinhaço, em Minas Gerais, Brasil, e a comparamos com as espécies de morfologia mais similar: *Paepalanthus actinocephaloides* Silveira e *P. barbiger* Silveira, ambas ocorrentes na Cadeia do Espinhaço.

Key words: *Actinocephalus*, Brazil, Eriocaulaceae, Espinhaço Range, IUCN Red List, Minas Gerais.

Eriocaulaceae are one of the most representative families from Brazilian rocky outcrops, comprising two subfamilies (Eriocauloideae and Paepalanthoideae) with 11 genera and approximately 1200 species. These species are mainly distributed in the mountains of the Espinhaço Range, with a secondary center of diversity in the mountains of Venezuela. In Brazil, the principal habitats occupied by these species occur in the montane rocky outcrops and montane grasslands from Minas Gerais and Bahia, but the taxa are also found in cerrado areas, especially in the states of Goiás, Mato Grosso, and São Paulo (Giulietti & Hensold, 1990; Hensold, 1991; Stützel, 1998).

In his treatment of the family for *Flora Brasiliensis*, Körnicke (1863) described *Paepalanthus* subgen. *Actinocephalus* Körnicke, comprising 21 species characterized by inflorescences with an umbellate arrangement of the capitula. Ruhland (1903) reduced this to sectional rank as *Paepalanthus* sect. *Actinocephalus* (Körnicke) Ruhland, adding to the original circumscription the possession of simple stigmas in the pistillate flowers. Finally, Sano (2004) elevated *Paepalanthus* sect. *Actinocephalus* to generic status as *Actinocephalus* (Körnicke) Sano. In his publication, the new genus was defined as possessing paraclades that bear inflorescences arranged as an umbel of capitula and by its simple stigmas in pistillate flowers, as well as by its karyotype. Ruhland (1903) and Sano (2004) each discussed the similarity of species in *Actinocephalus* to certain species within *Paepalanthus* subsect. *Aphorocaulon* Ruhland. As a result of revisionary studies in this group, Costa (2005) concluded that *Paepalanthus* subsect. *Aphorocaulon* should be merged in *Actinocephalus* and redefined the group as possessing paraclades and simple stigmas in the pistillate flowers.

Actinocephalus koernickeanus Trovó & F. N. Costa, sp. nov. TYPE: Brazil. Minas Gerais: Serro, Estrada para Capivari, 6.8 km da bifurcação para Diamantina, 25 Apr. 2007, *M. L. O. Trovó, M. T. C. Watanabe 372* (holotype, SPF; isotypes, B, MO). Figure 1.

Haec species a *Paepalantho actinocephaloide* Silveira foliorum apicibus barbatis et scapis paracladia aequantibus differt.

Perennial herbs, 25–30 cm tall; stems short, 1–2 cm. Leaves rosulate, flat, lanceolate, 2.5–4.5 × 0.3–0.6 cm, adaxial surface glabrescent, abaxial surface glabrous, apex acute, densely hairy, margins ciliate, base glabrescent. Paraclades 9–11 cm, ca. 1.5 mm diam., tomentose to glabrescent; paracladial bracts erect, lanceolate, 1.5–2 × 0.3–1.5 cm, both surfaces glabrous, apex acute, densely ciliate, margins with long trichomes, base semiamplexicaul, glabrous; spathes 1.5–3 cm, glabrous, apex acute; scapes 10 to 25 per paraclade, 9–12 cm, tomentose with simple trichomes; capitula 0.5–0.7 cm diam., hemispheric; involucral bracts light brown, elliptic, ca. 0.4 cm,

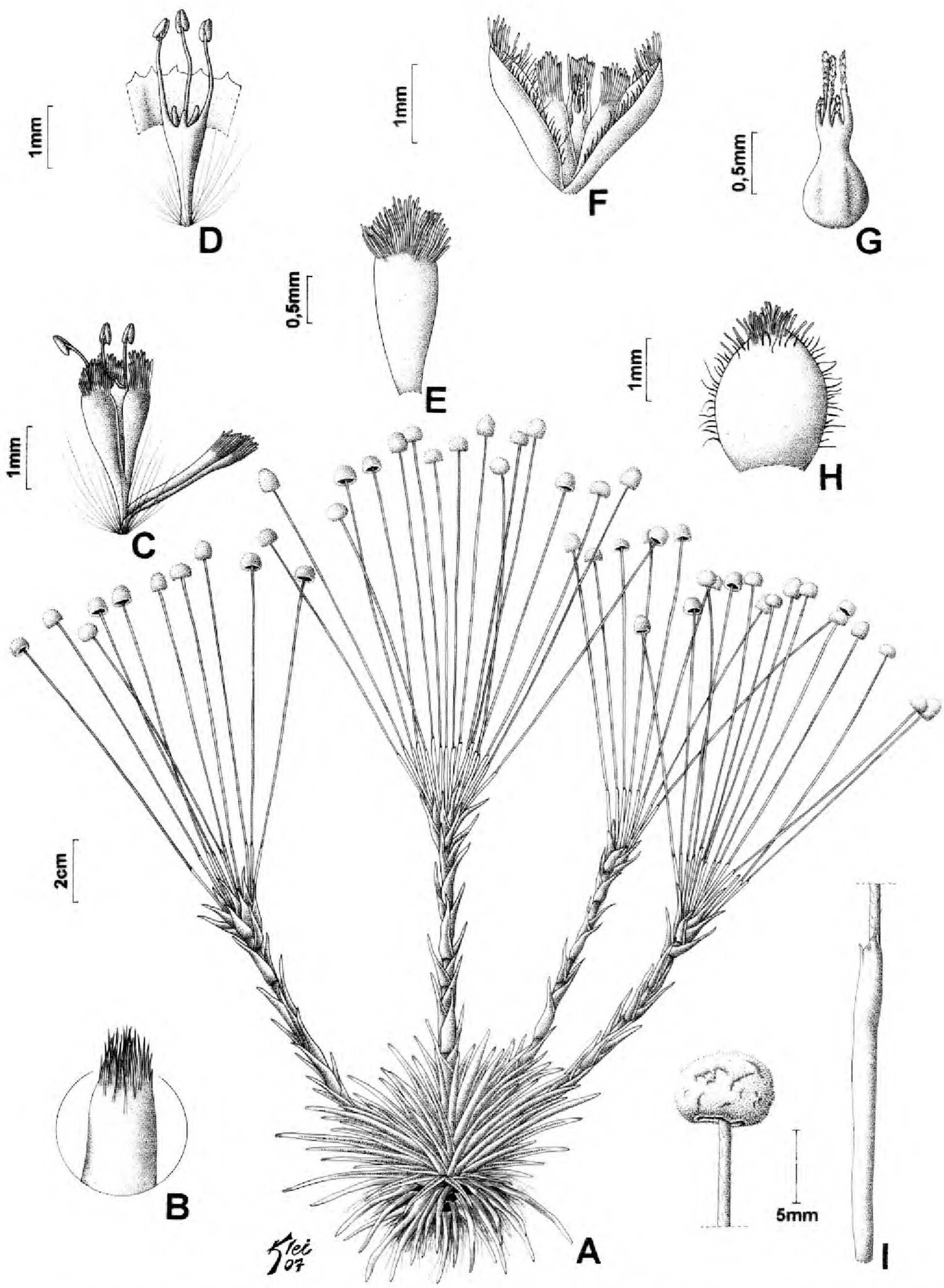

Figure 1. *Actinocephalus koernickeanus* Trovó & F. N. Costa. —A. Habit. —B. Leaf apex detail. —C. Staminate flower with floral bract. —D. Staminate flower with sepals removed. —E. Floral bract, adaxial surface. —F. Pistillate flower with one sepal removed. —G. Gynoecium detail. —H. Involucral bract, adaxial surface. —I. Spathe, scape, and capitulum detail. Drawn from the holotype *M. L. O. Trovó & M. T. C. Watanabe 372* (SPF).

apex obtuse, ciliate; receptacle hemispheric, pubescent. Flowers 3-merous, 80 to 90 per capitulum, ca. 3× more staminate flowers in relation to pistillate flowers; floral bracts obovate, ca. 0.3 cm, hairy on dorsal surface, apex acute, ciliate; staminate flowers ca. 0.4 cm; pedicel ca. 0.1 cm, with long trichomes; sepals obovate, ca. 0.4 cm, hairy in dorsal surface, apex acute, ciliate; corolla tubular, membranous,

Table 1. Morphological differences between *Actinocephalus koernickeanus*, *Paepalanthus actinocephaloides*, and *P. barbiger*.*

	A. koernickeanus	*P. actinocephaloides*	*P. barbiger*
Leaf apex	hairy	glabrous	hairy
Paraclade length (cm)	9–11	12–14	2–5
Scape length (cm)	9–12	7.5–8	12–36
Scape trichomes	simple	simple	T-shaped

*The measurements for *Paepalanthus actinocephaloides* and *P. barbiger* are cited from Costa (2005: 71, 78).

hyaline, ca. 1.5 mm, 3-lobed; stamens ca. 0.2 cm; pistillodes 3, papillose; pistillate flowers ca. 0.3 cm, sessile; sepals obovate, ca. 0.3 cm, hairy on dorsal surface, apex acute, ciliate; petals obovate, ca. 0.2 cm, hairy on dorsal surface, apex acute, ciliate; gynoecium ca. 0.2 cm, stigmatic portions filiform, twice as long as nectariferous portion; staminodes 3, scalelike. Fruit a loculicidal capsule.

Habitat and distribution. *Actinocephalus koernickeanus* occurs in the Espinhaço Range, in the state of Minas Gerais, near the city of Serro, along the road to Capivari, at approximately 1800 m altitude. The vegetation at the type locality is predominantly montane grassland, and the soil of the region is rocky.

IUCN Red List category. The species is known only from a single collection from a single population, with individuals occurring relatively far from each other. According to IUCN Red List criteria (IUCN, 2001), the species should be considered Critically Endangered (CR B1a).

Etymology. The epithet *koernickeanus* honors the German botanist Friedrich August Körnicke (1828–1908), who developed the greater part of the basis for the modern study of *Paepalanthus* Martius and, consequently, *Actinocephalus*, in his brilliant Eriocaulaceae monograph for the *Flora Brasiliensis*.

Discussion. *Actinocephalus koernickeanus* is affined with species affiliated within *Paepalanthus* subsect. *Aphorocaulon*. However, this subsection should be merged in *Actinocephalus* (Costa, 2005). Thus, we describe this species within *Actinocephalus* due to its paraclades bearing scapes and its simple stigmas. This genus now comprises 32 species occurring in Brazil.

Two species that are morphologically similar to *Actinocephalus koernickeanus* belong to *Paepalanthus* subsect. *Aphorocaulon*. *Paepalanthus actinocephaloides* is probably sympatric with *A. koernickeanus* but can be distinguished mainly by its scapes that are shorter than the paraclades and its leaves with a glabrous apex. Another similar species is *P. barbiger* Silveira, which is restricted to Morro do Breu (Serra do Cipó, Minas Gerais). It differs from *A. koernickeanus* mainly in the size of its paraclades and scapes, and by the scapes with T-shaped trichomes. More detailed morphological comparisons of these three species are given in Table 1.

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Stylosanthes rostrata (Leguminosae), a New Combination from Argentina and Uruguay

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ABSTRACT. As part of the revision of the genus *Stylosanthes* Swartz (Leguminosae) from South America, material from Corrientes, Argentina, described by Burkart as *S. gracilis* Kunth var. *rostrata* Burkart, is recognized at species rank as *S. rostrata* (Burkart) Vanni.

RESUMEN. Durante la revisión del género *Stylosanthes* Swartz (Leguminosae) para Sudamérica, el material de Corrientes, Argentina, descripto por Burkart como *S. gracilis* Kunth var. *rostrata* Burkart, es considerado una especie diferente *S. rostrata* (Burkart) Vanni.

Key words: Argentina, *Leguminosae*, *Stylosanthes*, Uruguay.

Stylosanthes gracilis Kunth was broadly interpreted by Burkart (1939) and included four varieties under the name, one of which was *S. gracilis* var. *rostrata* Burkart. The name *S. gracilis* var. *rostrata* was later considered by Mohlenbrock (1957) as a synonym of *S. montevidensis* Vogel, but he did not study type material of Burkart's variety or of *S. montevidensis*. The species was recently considered under the synonymy of *S. guianensis* (Aublet) Swartz var. *gracilis* (Kunth) Vogel.

Stylosanthes rostrata occurs in northeastern Argentina and Uruguay and is sympatric with *S. hippocampoides* Mohlenbrock and *S. montevidensis*. These three species maintain their particular characteristics within the same distributional area. *Stylosanthes hippocampoides* and *S. montevidensis* have a broader distributional range, occurring from southern Brazil and south into Paraguay, Uruguay, and Argentina.

Stylosanthes rostrata (Burkart) Vanni, comb. et stat. nov. Basionym: *Stylosanthes gracilis* Kunth var. *rostrata* Burkart, Darwiniana 3(2): 251. 1939. TYPE: Argentina. Corrientes: Granja de Bella Vista, 18 July 1905, *C. Spegazzini & C. D. Girola 54* [Min. Agr. 14648] (holotype, SI). Figure 1.

Plants perennial, branches prostrate to suberect, with setae and hair incurved, white, short. Leaves trifoliolate; stipules 11 mm, connate to the base or foliate, free in the upper half and then subulate, with setae and scattered curved trichomes; petioles 5–6 mm; leaflets 12–15 × 2–3 mm, narrowly elliptic, mucronate, apically setose; the lateral ones asymmetric, with the longest terminal; hypophyllus with scattered weak trichomes, evident, with white veins, with dense setae along the nerves, margins jagged with mucronate teeth; epiphyllus with setae. Inflorescences terminal or subterminal, in dense spikes, with up to 8 flowers; bracts similar to stipules, with central lamina ca. 8 mm, bracteoles 2, hyaline at flower bases. Flowers yellow. Fruit with a single article, ca. 6 × 3 mm, the lower article rarely developed, with evident longitudinal veins, glabrous, a few thick hairs on the open beak, ca. 1.5 mm, with a slight apical bend.

Distribution and habitat. *Stylosanthes rostrata* is found in northeastern Argentina (Corrientes) and in Uruguay in humid sandy soils.

Comments. *Stylosanthes rostrata* is similar to *S. hippocampoides*, differing mainly in the article beak of the fruit, which is more incurved in *S. hippocampoides*. *Stylosanthes rostrata* differs from *S. montevidensis* in the latter species having plants of juncoid aspect, with fewer leaves, and fruit with a strongly uncinate beak with yellowish hairs in the concavity.

Additional specimens examined. URUGUAY. **Colonia:** Riachuelo, Feb. 1930, *Herter 85562* (M, NY); La Colonia (río de la Plata), Feb. 1918, *L. Hauman s.n.* (BR).

Acknowledgments. Thanks are due to Ernestina Galeano for suggestions that improved the manuscript.

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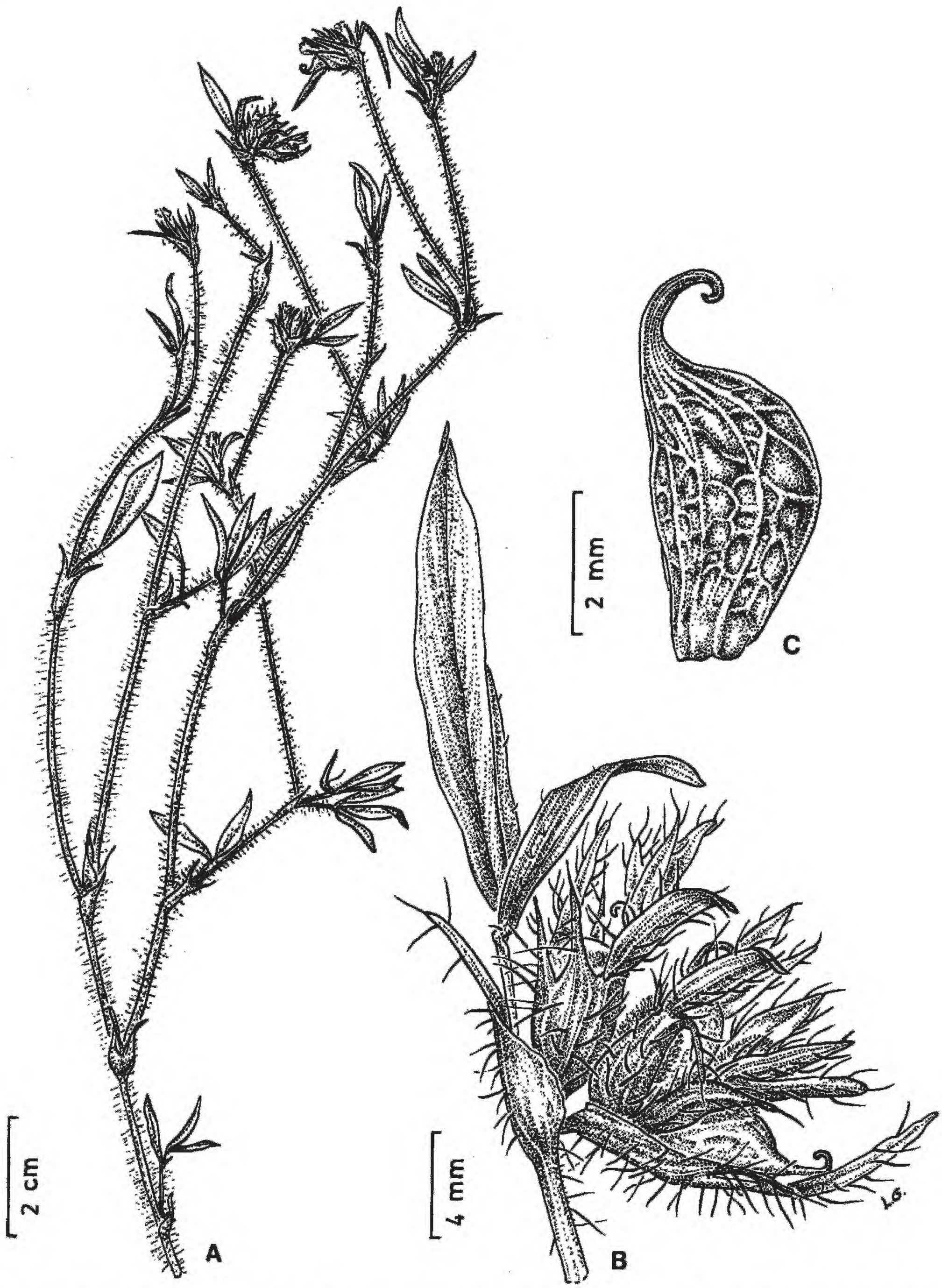

Figure 1. *Stylosanthes rostrata* (Burkart) Vanni. —A. Branch. —B. Inflorescence. —C. Fruit. Drawn from the holotype, *Spegazzini & Girola 54* (SI).

Petrocosmea xingyiensis (Gesneriaceae), a New Species from Guizhou, China

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Abstract. A new species, *Petrocosmea xingyiensis* Y. G. Wei & F. Wen, is described and illustrated from Maling Gorge, Xingyi County, Guizhou Province, China. The new species differs from related species in the genus by its narrowly oblanceolate leaves that are pubescent on both surfaces.

Key words: China, Gesneriaceae, Guizhou, IUCN Red List, *Petrocosmea*.

Petrocosmea Oliver (Gesneriaceae) was established in 1887 and is comprised of 27 species (Li & Wang, 2004), 24 of which are found in China (Wang et al., 1990, 1998). These plants are characterized as perennial, terrestrial or epipetric, and stemless (Li & Wang, 2004). The inflorescences are usually lax, rarely in subumbels, with corollas that are blue to purple or white, and zygomorphic. The new species is distinctive in its narrowly oblanceolate leaves that are pubescent on both surfaces, which differs from the possibly related *P. grandiflora* Hemsley.

Petrocosmea xingyiensis Y. G. Wei & F. Wen, sp. nov. TYPE: China. Guizhou: Xingyi, Maling Gorge, 10 Sep. 2006, *F. Wen 06101* (holotype, IBK). Figure 1.

Haec species *Petrocosmeae grandiflorae* Hemsley affinis, sed ab ea foliis anguste oblanceolatis utrinque pubescentibus differt.

Perennial herb, rosettes, with short rhizome and crowded fibrous roots. Leaves 16 to 30, all basal, crowded, the inner leaves with petiole short or absent, the outer leaves with longer petiole; leaf blades papery when dry, narrowly oblanceolate, 0.3–3 × 0.2–0.7 cm, apex obtuse, base cuneate, margin entire, pubescent on both surfaces, lateral veins 2 to 3 on each side, not distinct; petioles 0.6–2.5 cm, densely pubescent. Cymes 2 to 3, 1-flowered; peduncle 3–4.4 cm, pubescent; bracts 2 or 3 at mid-peduncle, ovate, 1–2 mm, pubescent; sepals 5, triangular to ovate, ca. 4 × 2 mm, pubescent externally; corolla blue, sparsely pubescent externally; corolla tube ca. 7 mm, lobes ovate to rounded, adaxial lip ca. 6 × 6 mm, bi-lobed to basal 1/7, abaxial lip ca. 8 × 8 mm, tri-lobed to basal 1/2; stamens 2, ca. 5 mm; filaments adnate to ca. 1 mm above base of corolla tube, ca. 4 mm long, pubescent; anthers ovate, ca. 3 mm, glabrous; staminodes 2, adnate to ca. 1 mm above base of corolla tube, ca. 2 mm long, glabrous; pistil ca. 8 mm; ovary pubescent; style pubescent, ca. 6 mm.

Habitat and distribution. *Petrocosmea xingyiensis* is known from cliffs of limestone rock or along the Qingshuihe River, at 930–1000 m elevation in Maling Gorge, Xingyi County, Guizhou Province, in southwestern China.

IUCN Red List category. The new species is assessed as Critically Endangered (CR A2c) according to IUCN Red List criteria (IUCN, 2001). Approximately 330 individuals were found in three separate, restricted localities in the gorge: 10 individuals growing in the first locality of ca. 1 × 1 m^2, 20 individuals in the second locality of ca. 2 × 2 m^2, and ca. 300 individuals in the third locality of ca. 10 × 10 m^2. There is a path connecting and adjacent to the three localities, which many tourists access daily and which represents the principal threat to the plants.

Phenology. *Petrocosmea xingyiensis* has been collected in flower in September–October; fruits not seen.

Discussion. Based on floral structure, notably the anthers that are not constricted, the actinomorphic calyx divided in five segments, the upper lip ca. one half the length of the lower lip, and the inconspicuously two-lobed upper lip that is slightly concave, *Petrocosmea xingyiensis* belongs to sect. *Anisochilus* ser. *Iodioides*. The new species is related to *P. grandiflora*, but differs in several characters (Table 1).

Paratype. CHINA. **Guizhou:** Maling Gorge, Xingyi, 7 Oct. 1998, *S. K. Wu, Y. Tateishi, T. Sugawara 10432* (KUN, MAK).

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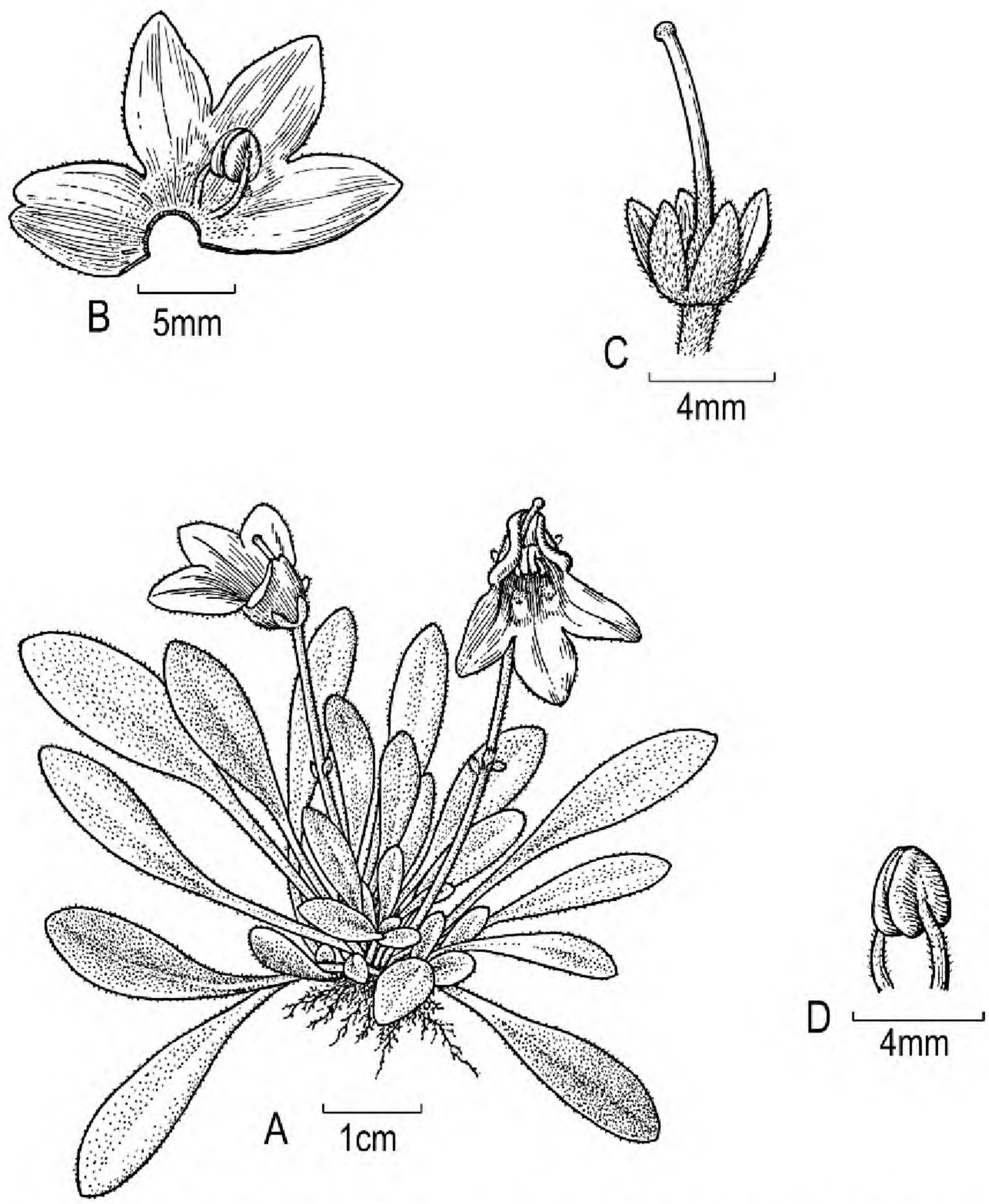

Figure 1. *Petrocosmea xingyiensis* Y. G. Wei & F. Wen. —A. Habit. —B. Dissected corolla. —C. Calyx and pistil. —D. Stamens. Drawn from the holotype *F. Wen 06101* (IBK) by S. Q. He.

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Table 1. Diagnostic characters of *Petrocosmea xingyiensis* and *P. grandiflora*.

	P. xingyiensis	*P. grandiflora*
Leaves	narrowly oblanceolate, pubescent on both surfaces	elliptic or lanceolate to broadly ovate, adaxially sericeous, abaxially sparsely sericeous
Corolla	adaxial lip ca. 0.6 cm, bi-lobed to basal 1/7	adaxial lip ca. 0.9–1 cm, bi-lobed to basal 1/3–1/2

Kengyilia zadoiensis, a New Species (Gramineae, Triticeae) from Qinghai, China

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Abstract. *Kengyilia zadoiensis* S. L. Lu & Y. H. Wu, a new species of Gramineae from Zadoi County, Qinghai Province, China, is described and illustrated. The new species is related to *K. kokonorica* (Keng ex Keng & S. L. Chen) J. L. Yang, C. Yen & B. R. Baum. *Kengyilia zadoiensis* is distinguished by auricles on either side of the summit of leaf sheaths, glabrous glumes, muticous glumes that lack awns, lemmas that are 7–9 mm long, with an awn 4–10 mm, and anthers that are yellow-green, ca. 1 mm long.

Key words: China, Gramineae, IUCN Red List, *Kengyilia*, Qinghai, Triticeae.

During July and August 2005, while on an expedition to Lancang jiang, numerous specimens of Gramineae were collected from Zadoi County, Qinghai Province, China. These specimens were all identified from the literature, and new species were discovered, including the new species for *Kengyilia* C. Yen & J. L. Yang described here.

1. **Kengyilia zadoiensis** S. L. Lu & Y. H. Wu, sp. nov. TYPE: China. Qinghai: Zadoi Co., Angsai, NW valley, in meadow by alpine forest & shrub, 4200 m, 10 July 2005, *Wu Yu-hu 33208* (holotype, HNWP; isotype, HNWP). Figure 1.

Species nova affinis *Kengyiliae kokonoricae* (Keng ex Keng & S. L. Chen) J. L. Yang, C. Yen & B. R. Baum, sed ab ea vagina foliari auriculis lanceolatis 1–1.5 mm longis apice praedita, glumis glabris apice acuminatis muticis, lemmatibus 7–9 mm longis apice in aristam 4–10 mm longam desinentibus atque antheris flavovirentibus ca. 1 mm longis differt.

Perennial herb; culms erect, usually solitary, geniculate at base, 50–75 cm, glabrous, with pubescence on lower half of spike only, 3- to 4-noded, nodes black, upper internode only to 1/3 culm length. Leaf sheaths smooth, glabrous, shorter than internodes, with 2 lanceolate auricles at sheath apex, 1–1.5 mm; ligule ca. 0.5 mm, glabrous; leaf blades on culms erect, sometimes complanate or involute, glabrous on both surfaces, 7–10 × 2–3 mm, basal leaves to 20 cm. Spikes crowded, erect or slightly decurved, 7–10 cm; rachis internodes 3–5 mm, ca. 9 mm at base, densely pubescent. Spikelets sessile, with 4 to 8 florets, imbricate, often secund, 7–12 mm, excluding awn, ashy green or fulvous; glumes broadly lanceolate, glabrous, 3-nerved, apex acuminate, muticous, with a mucro 0.5–1 mm, without awn, with broad membranous margins, with only faint lateral nerves; proximal glumes ca. 4 mm, distal glumes ca. 5 mm; lemmas oblong to lanceolate, densely hispid, apex awned, with awn 4–10 mm, scabrous, erect or slightly recurved; callus pubescent; first lemmas 7–9 mm, paleas nearly subequal to lemmas, ciliate along 2 keels, but otherwise glabrous; anthers yellow-green, ca. 1 mm. Only immature caryopses seen.

Habitat and distribution. *Kengyilia zadoiensis* is endemic to China. The type specimen was collected in a meadow valley near alpine forest and shrub, at an elevation of 4200 m, in a valley northwest of Angsai village, Zadoi County, Qinghai Province, China.

IUCN Red List category. *Kengyilia zadoiensis* should be considered Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001). The new species has a very small range and limited population size; fewer than 10 plants were seen in this population during the collection expedition. Furthermore, habitat destruction represents a significant threat in China, and no protection is currently established in the type locality.

Phenology. The new species was collected in flower in July.

Etymology. *Kengyilia zadoiensis* is named for the type locality in Zadoi County, Qinghai Province, China.

Discussion. The new species is related to *Kengyilia kokonorica*, and both taxa occur in similar habitat and geographic areas. However, *K. zadoiensis* is distinguished by auricles on either side of the summit of leaf sheaths, glabrous glumes, muticous glumes that lack awns, lemmas that are 7–9 mm long, with an awn 4–10 mm, and anthers that are yellow-green, ca. 1 mm long (Keng, 1959; Yang & Wang, 1987; Cai, 1997, 1999; Wu & Wang, 1999; Chen & Zhu, 2006).

Acknowledgments. Lu Sheng-lian assisted the author in the specimen's appraisal and in the initial

Figure 1. *Kengyili zadoiensis* S. L. Lu & Y. H. Wu. —A. Plant (×1). —B. Part of leaf sheath showing apex with auricles (×2). —C. Intact spikelet (×3). —D. Proximal glume (×5). —E. Distal glume (×5). —F. Lemmas (×5). —G. Paleas (×5). —H. Anthers (×6). Drawn from the holotype *Wu Yu-hu 33208* (HNWP) by Tao Ming-qin.

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A New Genus of Holoparasitic Orobanchaceae from Mexico

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Abstract. We describe here a novel achlorophyllous parasite on the roots of *Hedyosmum mexicanum* C. Cordemoy (Chloranthaceae) as a new genus and species, *Eremitilla mexicana* Yatskievych & J. L. Contreras. The new taxon is currently thought to be endemic to the state of Guerrero, Mexico. It is best classified in the Orobanchaceae, but differs from other members of the family in having 5-ribbed, muricate ovaries containing five parietal placentae, as well as unusual stamens in which the anther is partially embedded in an expanded filament apex. Within the Orobanchaceae, the new taxon is probably related to a group that contains the other American holoparasitic genera. Morphologically, *Eremitilla* Yatskievych & J. L. Contreras displays a number of autapomorphies, but few identifiable synapomorphies. This presumed relictual taxon presently is known only from a restricted habitat and a very small geographic range, and thus is of conservation concern.

Key words: Chloranthaceae, *Eremitilla*, Guerrero, *Hedyosmum*, IUCN Red List, Mexico, Orobanchaceae, parasitic plant.

In June 1985, during fieldwork in Guerrero, Mexico, New York Botanical Garden Curator Wayt Thomas stumbled upon a single inflorescence of an unusual achlorophyllous plant. He pressed a specimen and later sent this to Lawrence Heckard at the University of California, a specialist on the taxonomy of the parasitic plant family, Orobanchaceae. The late Dr. Heckard could not place the specimen; he concluded that the plant probably was not a member of the Orobanchaceae and suggested instead that it might represent an unnamed member of the mycoheterotrophic Monotropaceae (now considered a subfamily of the Ericaceae). For the next two decades, the specimen remained an undetermined entry in Dr. Thomas's field notebook.

In 2005, Thomas showed a photograph of the plant to Gerald Schneeweis of the University of Vienna, who has been conducting molecular phylogenetic studies of the Orobanchaceae. Through the courtesy of Schneeweis, the specimen eventually found its way to Yatskievych's attention. The senior author has been collaborating with L. Turner Collins (Evangel University) and Alison Colwell (U.S. National Park Service) on taxonomic studies and a floristic treatment of the holoparasitic genera of Orobanchaceae for the Flora of North America Project. The present study is an extension of that research.

It quickly became clear that regardless of its familial placement the original specimen represented an undescribed taxon. However, the material available at the start of the research was insufficient to allow a detailed morphological analysis without doing significant damage to the only specimen, and the lack of the basal portion of the original plant precluded a determination of whether the taxon had a parasitic or mycotrophic habit. As a young graduate student at the Universidad Nacional Autónoma de México (UNAM), the junior author accompanied Wayt Thomas on his 1985 botanical expedition and has continued to pursue floristic studies in the mountains of Guerrero. His experience with the flora and geography of the region gave hope that living material of this unusual plant might be rediscovered in the wild for further study.

Following unsuccessful searches for additional specimens in pertinent herbaria in the United States and Mexico, fieldwork was conducted in the region of the historical collection in Guerrero, Mexico, during June 2006 and July 2007 to locate and document plants in flower and fruit. Descriptions of the sites were compiled, including lists of the most significant components of the vegetation. Excavations were made to confirm the identity of the hosts (and to document the below-ground portions of the parasites), but because of the relatively small numbers of parasites present, only one host root was excised and collected. Both in situ and excavated material of the parasite and

host were documented by digital photography and voucher specimens.

Pollen samples were mounted in glycerol for examination by light microscopy. Pollen samples for scanning electron microscopy (SEM) were acetolyzed for 8 minutes at 90°C using standard techniques (Erdtman, 1960), then dehydrated in an ethanol series and critical point–dried. Both pollen and seeds (the latter air-dried, unpretreated) were sputter-coated with gold-palladium and viewed on a Hitachi S-2600H scanning electron microscope (Hitachi, Tokyo, Japan). Leaf surfaces (to check for stomates) were viewed directly under a compound microscope from epidermal peels of liquid-fixed material and also from dried material using the cellulose acetate cast technique of Payne (1968).

Eremitilla mexicana Yatskievych & J. L. Contreras, gen. et sp. nov. TYPE: Mexico. Guerrero: Mpo. Gral. de Heliodoro de Castillo, 91 rd. km W of turnoff of Mexico Hwy. 95 Libre (N of Zumpango del Río) & 2.8 rd. km W of village of Tiquimil on dirt rd. heading W across the Sierra Madre del Sur to Puerto de Gallo, in rocky, steep-walled ravine with small permanent stream crossing rd., 17°31′27.1″N, 99°57′01.3″W, 1955 m, 12 June 2006, *G. Yatskievych & J. L. Contreras J. 06-43* (holotype, MEXU; isotype, MO). Figures 1–3.

Genus novum et species nova, solitaria apud species Orobanchacearum ovariis valde quinqueangulosis, verrucosis, unilocularibus, placentis quinque parietalibus.

Perennial root parasites, achlorophyllous; not producing roots, forming amorphous, swollen, somewhat flattened vegetative bodies laterally along host roots; these bearing current year's stems and black, senescent bases of previous year's stems; stems solitary or in clusters of 2 to several from each vegetative body, 15–45 cm, unbranched, succulent, geniculate basally, where 6–12 mm diam., ascending irregularly to at or just above the soil surface, where 16–25 mm diam., ± cylindrical (with irregularly thinner and thicker portions), yellow externally and internally, quickly oxidizing to brown when damaged. Leaves squamiform, densely spirally imbricate, those near the stem base 4–6 × 5–8 mm, broadly oblong to depressed-ovate, rounded to broadly angled at the tip; grading quickly into those of the main stem, these 10–22 × 7–14 mm, angled to a bluntly or sharply pointed tip; all leaves glabrous, finely longitudinally striate, with erose margins, the basalmost dark brown, the main cauline leaves yellow, but those in a distal band 1.5–6.5 cm somewhat sclerified, blackish, shiny. Inflorescences solitary, stout, terminal spikes, hemispheric to ovoid, the flowers densely spirally imbricate; bract 1 per flower, 21–28 × 14–18 mm, ovate to elliptic above a short, broad, stalklike base, the laminar portion somewhat concave (cupped around the flower), angled or slightly acuminate to a usually sharply pointed tip, the margins strongly erose, adaxially glabrous and reddish brown to reddish purple above the yellow base, abaxially densely vesicular-hairy (described under corolla) and blackened toward the tip, sometimes with the thinner margins brownish yellow; bracteoles usually present, usually 2, ± aligned with lateral sepals, 14–21 × 7–12 mm, narrowly elliptic to narrowly rhombic above a broad stalklike base, curved or bent medially, otherwise similar to the bracts. Calyces ± actinomorphic, of (4)5 sepals, these 18–25 × 9–15 mm, attached separately on the corolla tube near its base, persistent, the stalklike proximal portion slightly shorter than to about as long as the laminar portion, this ovate, concave and curved or bent medially (cupped around and loosely appressed to the corolla), angled to a bluntly or sharply pointed tip, the margins strongly erose, reddish brown to reddish purple above the yellow to pale yellow base, the thinner margins brownish yellow, adaxially glabrous, abaxially densely vesicular-hairy (described under corolla); corolla aestivation cochleate-imbricate (the upper corolla lobe exterior in the bud); corollas zygomorphic, 4-lobed (by almost complete fusion of the 2 upper lobes of a 5-merous corolla), overall 24–28 mm and somewhat arcuate, persistent and becoming papery at fruiting; the tube 10–13 mm long and wide, glabrous, mostly cream-colored to pale yellow, abruptly constricted distally on the ventral side above the ovary, reexpanded to 14–17 mm diam. in the throat (here defined as the expanded, tubular portion above the constriction and below the lobes), this 2–4 mm long, the throat and lobes mostly dark red externally in proximal portion, grading into reddish brown distally, densely pubescent externally with dull yellow to yellowish orange, vesicular hairs 0.3–0.5 mm, small groups of these sometimes coherent basally into short linear clusters; the lobes 10–13 mm, slightly overlapping laterally at anthesis, strongly erose and yellowish-hyaline along the margins, the upper lobe twice as wide as the others, shallowly cucullate, very broadly oblong, shallowly notched along the otherwise ± truncate tip, the lateral lobes and lower lobe depressed-ovate to broadly oblong-ovate, shallowly concave (appearing slightly incurved); stamens 4, not exserted, the filaments free, inserted at the ovary base, 14–18 mm, equal in length or those of the anterior pair slightly longer than those of the posterior pair, relatively stout, not flattened, glabrous, white to cream-colored, ascending along the sinuses of the ovary, curved and somewhat connivent

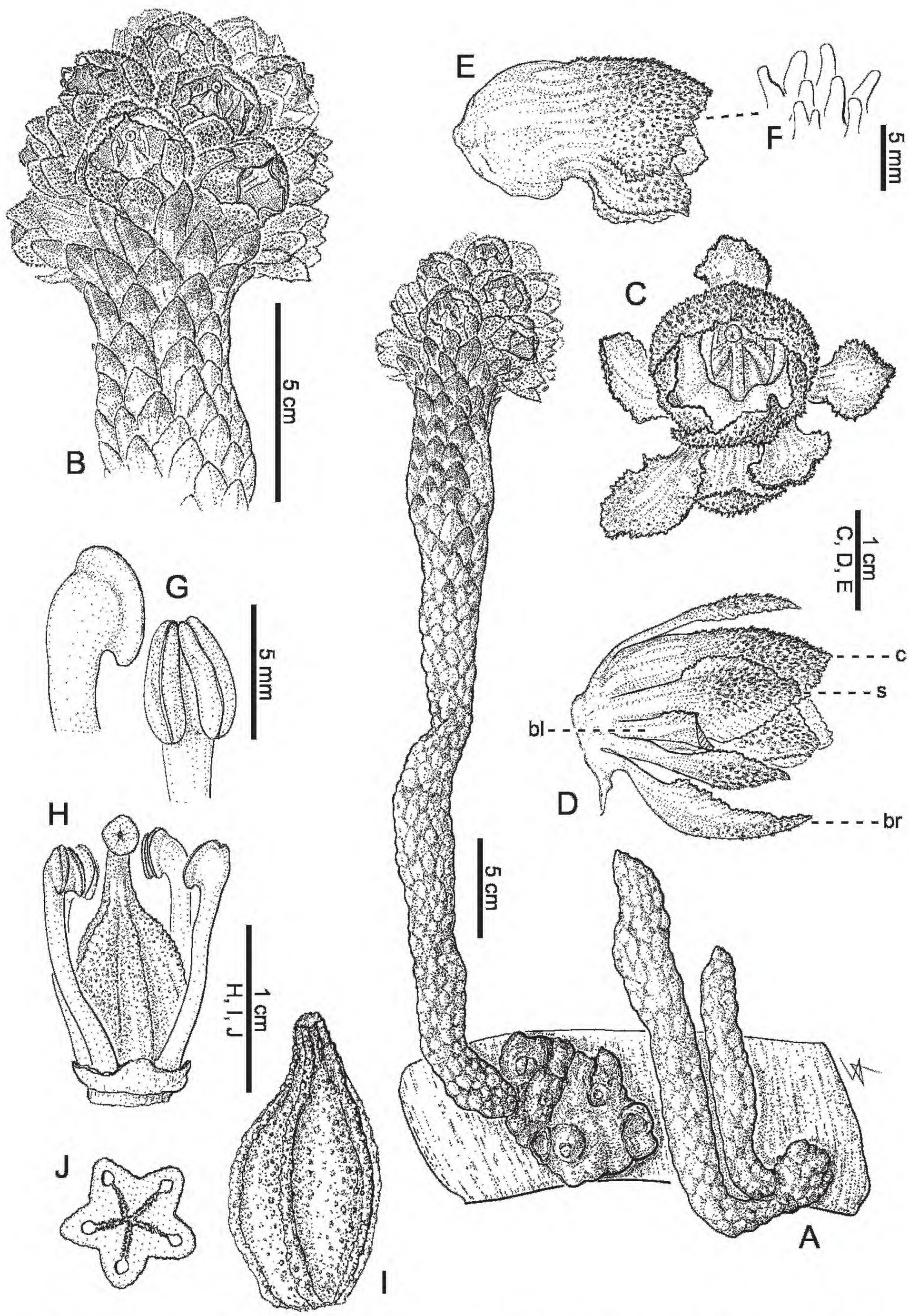

Figure 1. *Eremitilla mexicana* Yatskievych & J. L. Contreras. —A. Habit, including portion of host root. —B. Inflorescence and upper stem. —C. Flower, frontal view, with sepals and bract spread to facilitate observation of corolla. —D. Flower, lateral view; bl, bracteole (distal portion removed to avoid obscuring perianth); br, bract; c, corolla; s, sepal. —E. Corolla, lateral view. —F. Vesicular trichomes. —G. Stamens, lateral and ventral view of anthers and filament tips. —H. Flower with bract, bracteoles, and perianth removed to expose stamens and pistil. —I. Fruit. —J. Cross section of ovary showing placentae. A–H, J, drawn from *Yatskievych & Contreras J. 06-43* (MEXU, MO); I, drawn from *Yatskievych, Olson & Trejo H. 07-106* (MEXU, MO, NY).

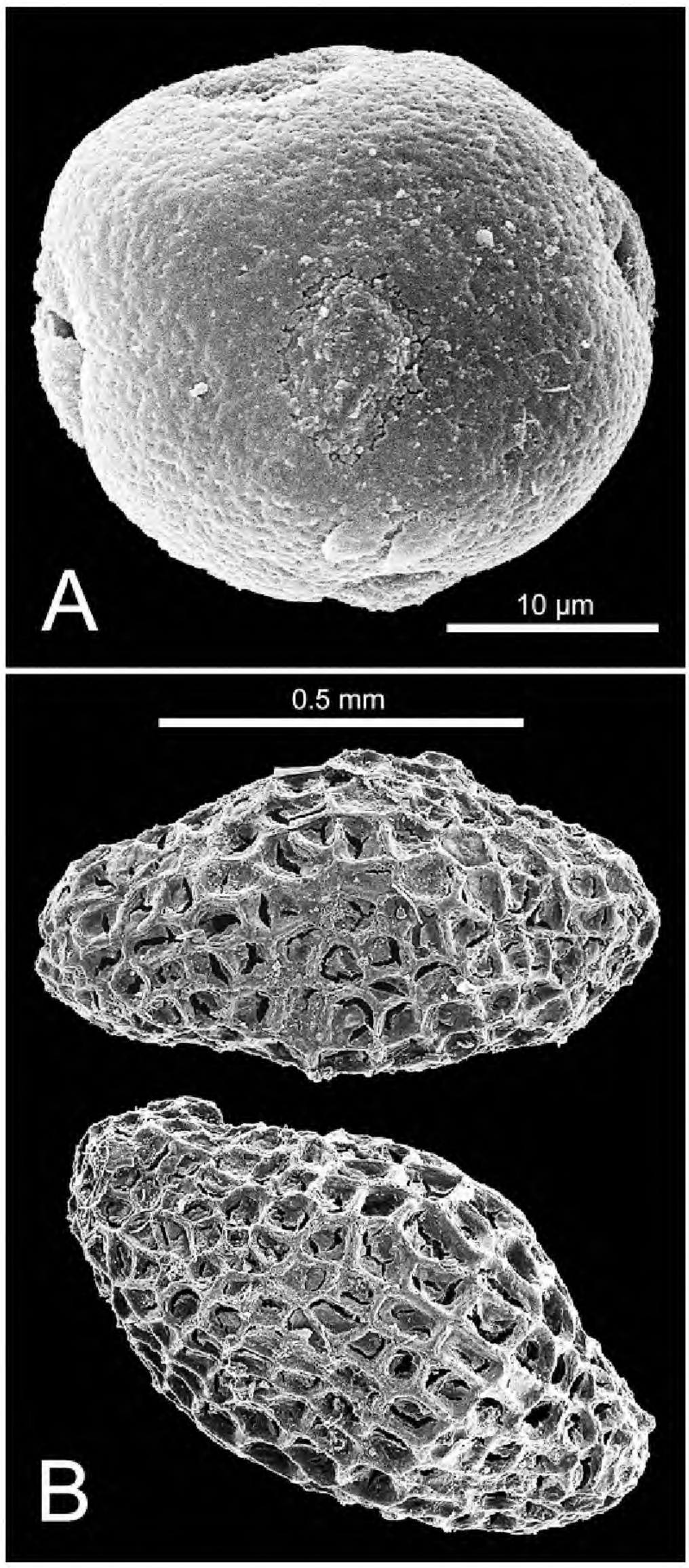

Figure 2. Pollen grain and seeds of *Eremitilla mexicana* Yatskievych & J. L. Contreras. —A. Pantoporate pollen grain, with six equidistant pores (*Yatskievych & Contreras J. 06-45*). —B. Seeds, showing the deeply reticulate outer surface (*Yatskievych et al. 07-106*).

distally under the upper corolla lobe, expanded abruptly apically, the anthers attached dorsally, but appearing partially embedded in the expanded tip, 4.0–4.9 mm long, glabrous, pale yellow grading to yellow, dithecate, the thecae ± parallel, narrowly oblong-reniform, each dehiscing on the ventral side by a longitudinal slit (the slits ventral rather than lateral), often with a narrow line of dark reddish purple along the slit; pollen sticky, the grains shed as monads or irregularly coherent, globose or nearly so, yellow, 26–30 µm diam. pantoporate with 4 equatorial and 2 polar, equidistant pores, the exine surface foveolate and slightly rugulate with scattered microperforations; pistil 1, apparently of 5 fused carpels, the ovary ovoid, 12–15 mm long, strongly 5-angled with slightly concave sinuses and rounded ribs (appearing fluted), the surface muricate, otherwise glabrous, pale yellow, short-tapered apically into the solitary style, this 5–8 mm long, not exserted, strongly arcuate under the upper corolla lobe, hollow, ± persistent (the apex sometimes breaking off irregularly) at fruiting, white proximally, grading abruptly into dark red or dark reddish purple distally, the stigma 1, discoid-crateriform, 2.0–2.5 mm diam., ± circular (sometimes slightly irregular or very slightly 5-lobed), dull yellow, with a minute, ± 5-lobed, central pore; locule 1, with 5 massive placentae intrusive from the sinus portions of the ovary wall, these irregularly 2- or 3-lobed, the ovules numerous, minute, white. Fruits capsular, but essentially indehiscent (decaying in situ), overall 16–20 mm, the body ovoid, tapered to an irregular, short beak, plump (not concave between the ribs), strongly 5-ribbed, the surface muricate, reddish-tinged to reddish brown at maturity, becoming dark brown to black with age; seeds numerous, 0.4–0.9 mm, irregularly ellipsoid to obovoid, reddish brown with dark brown ridges, the surface appearing reticulate (by enlarged cells of outer testa whose outer walls rupture at maturity), the pits irregularly polygonal.

Phenology. *Eremitilla mexicana* flowers during June and July.

Etymology. From the Latin, *Eremitilla mexicana* translates literally to "little hermit of Mexico," an allusion to the plant's secretive habit and limited occurrence.

Distribution. Based on current knowledge, this species is endemic to the inland slope of the Sierra Madre del Sur in Guerrero, Mexico, at elevations of 1800–2000 m.

Habitat. The mostly unpaved road along the inland side of the Sierra Madre del Sur in the Mexican state of Guerrero climbs gradually from ca. 500 m near its eastern terminus at the junction with Federal Highway 95 north of Chilpancingo to a maximum elevation of ca. 3200 m to the east of Puerto Gallo. The linear distance between these points is only about 75 air km, but the road requires more than 140 km to span this distance. Along the route, it passes through several vegetation zones. The lowest elevations are a dry, deciduous woodland dominated by various Fabaceae and Cactaceae (a matrix of matorral xerófilo and bosque tropical caducifolio,

Figure 3. *Eremitilla mexicana* Yatskievych & J. L. Contreras. —A. Type locality, bottom of mesic ravine. —B. Inflorescence. —C. Forest floor, showing inflorescence in situ (to left of center). —D. Detail of infructescence. —E. Close-up of flowers, showing orientation of perianth, androecium, and gynoecium. —F. Section of host root with two separate infections; note that current year's flowering stems have been removed from left-hand infection (see interpretive drawing in Fig. 1A). —G. Stem detail, showing appressed squamiform leaves. (B, C, E–G from *Yatskievych & Contreras J. 06-43* [type], D from *Yatskievych et al. 07-106.*)

sensu Rzedowski, 1981). The highest elevations support a mixed conifer-evergreen hardwood montane forest dominated by *Pinus* L., *Abies* Miller, *Quercus* L., and various other hardwoods, with many Ericaceae in the understory and a thick layer of mosses on the ground. Substrates are mostly of igneous and volcanic origin, except for an unusual area of weathered, dissected limestone near the village of Yextla.

Despite extensive searches in suitable habitat during two field seasons, only two populations of *Eremitilla* were discovered, each with fewer than 20 inflorescences. The apparent site of the initial 1985 discovery had suffered the effects of a fire that killed most of the primary woody vegetation and was in an early stage of recovery; no plants of the new taxon were present. Conversations with local villagers lead us to believe that additional plants exist in more remote parts of the area, but the rugged terrain and lack of roads and trails precluded further searches during the time available for our work.

The two sites where we were able to study the new taxon are about 1 km apart and about 90 km from the eastern end of the road. At this intermediate elevation of ca. 1800–2000 m, the main vegetation consists of pine-oak forests. Dissecting this landscape is a network of steep-walled, rocky ravines, most of which have small springs feeding into streams that are the primary sources of water for local villages and farms. The steep walls and permanent flow in these headwater drainages provide a permanently moist, humid microenvironment that supports a diversity of tropical hardwoods (some of these trees to more than 20 m tall) and herbaceous plants (Fig. 3A). The transition between this restricted habitat and the surrounding seasonally dry forests usually is very abrupt.

Woody plants recorded in the ravines that harbor the new taxon include one or more species in the following genera: *Alnus* Miller (Betulaceae), *Ardisia* Swartz (Myrsinaceae), *Canavalia* DC. (Fabaceae), *Clethra* L. (Clethraceae), *Conostegia* D. Don (Melastomaceae), *Croton* L. (Euphorbiaceae), *Eugenia* L. (Myrtaceae), *Fuchsia* L. (Onagraceae), *Hedyosmum* Swartz (Chloranthaceae), *Miconia* Ruiz & Pavón (Melastomaceae), *Oreopanax* Decaisne & Planchon (Araliaceae), *Pinus* (Pinaceae), *Pithecellobium* Martius (Fabaceae), *Quercus* (Fagaceae), *Rapanea* Aublet (Myrsinaceae), *Salvia* L. (Lamiaceae), *Smilax* L. (Smilacaceae), and *Ternstroemia* Mutis ex L. f. (Pentaphylaceae). Herbaceous genera include: *Adiantum* L. (Pteridaceae), *Amicia* Kunth (Fabaceae), *Aneilema* R. Brown (Commelinaceae), *Asplenium* L. (Aspleniaceae), *Begonia* L. (Begoniaceae), *Botrychium* Swartz (Ophioglossaceae), *Dioscorea* L. (Dioscoreaceae), *Gonolobus* Michaux (Apocynaceae), *Hydrocotyle* L. (Araliaceae), *Matelea* Aublet (Apocynaceae), *Pteris* L. (Pteridaceae), *Thelypteris* Schmidel (Thelypteridaceae), and *Woodwardia* Smith (Blechnaceae).

Both of the localities from which *Eremitilla* was documented have sustained minor impacts. These include the construction of the dirt road (and associated bank stabilization) across the ravine, diversion by pipe of a portion of the water in the streams, and selective timber removal. Many of the other drainages along the road have sustained more significant impacts from timber harvesting, fire, livestock, and colonization by early-successional plant species, such as *Pteridium* Gleditsch ex Scopoli and *Rubus* L., including the presumed site of the original discovery of the parasite.

IUCN Red List category. As an apparently localized endemic, *Eremitilla mexicana* may best be considered a relictual taxon. Taxonomically isolated within the Orobanchaceae, the species probably is a relatively old one that may once have been more abundant when habitat suitable for its host plant was more continuous. Given the sporadic occurrence in the region of headwater drainages with suitable microhabitats for the host species, the parasite is likely dispersal-limited. Under such a scenario, *E. mexicana* naturally and gradually may be approaching extinction. The inland slope of the Sierra Madre del Sur in Guerrero still has abundant primary forests, but long-term logging operations in the region inevitably are taking their toll. The practice of burning cut-over areas to prevent recruitment of woody species and the conversion of many logged areas into pasturage or orchards creates additional impacts to the mesic ravines by increasing local erosion and potentially causing changes in the surface hydrology. Plant species that have a limited ecological niche are among those most vulnerable to decline as a result of habitat degradation. The observation that *E. mexicana* only flowers when attached to large lateral roots of mature trees further narrows the potential habitat for the species. It is not known whether the soil seed bank for the parasite is especially long-lived.

According to Todzia (1988), *Hedyosmum mexicanum* C. Cordemoy is relatively widespread, with a range from central Mexico to Costa Rica, and occurs variously at elevations of 700–3200 m. It is the only species of *Hedyosmum* to occur in Mexico and, aside from some Caribbean species, has the most northerly distribution in the genus. Given the relatively broad distribution of *H. mexicanum* in North and Central America and its relatively great elevational range, it is surprising that *Eremitilla* has not been discovered growing in other places. Perhaps the present publi-

cation will alert collectors to be on the lookout for this unusual plant and it will be discovered elsewhere in Mexico or Central America. Certainly, it should be searched for along the inland side of the Sierra Madre del Sur in other Mexican states from Jalisco to Chiapas. The parasite is relatively easily overlooked by collectors, flowers above ground only during part of the year, and blends in with the leaf litter, thus the species probably is best considered Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001). However, based on the current data alone, the species would have to be classified at least as Vulnerable (VU) in that system (IUCN, 2001).

Taxonomic relationships. The parasitic habit of *Eremitilla mexicana* precludes its classification among the mycoheterotrophic members of the Ericaceae subfam. Monotropoideae. The production of four loosely connivent stamens (vs. six to 12) per flower (Figs. 1G, H, 3E) and the small seeds with an enlarged outer testa layer (Fig. 2B) (vs. minute seeds with a very thin testa one cell layer thick) provide morphological support for this interpretation. Flowers of *Eremitilla* also lack other characters that are common (but not ubiquitous) among the monotropoid ericads (Cronquist, 1981), such as actinomorphic corollas, production of well-developed nectaries, axile placentation, short styles, and resupinate anthers. However, it is easy to understand why the late Larry Heckard would have annotated the original specimen as possibly belonging to this group, given the distinct sepals and strongly 5-angled ovary (Fig. 1H, J).

Placement of *Eremitilla* in the Orobanchaceae is most parsimonious. Root parasitism is a synapomorphy above the basal branch in the family and a number of genera produce a well-defined vegetative body from which the flowering stems arise (Figs. 1A, 3F). The flowers of *Eremitilla* are similar to those of most Orobanchaceae in their basically 5-merous perianth with a zygomorphic corolla (Figs. 1C, 3E), as well as an androecium of four stamens (Figs. 1H, 3E) and an ovary with parietal placentation (Fig. 1J). The inflorescences of *Eremitilla* bear a strong resemblance to those of some genera of Orobanchaceae, both in terms of their organization and in the production of bracts and bracteoles. The seeds of *Eremitilla* also are of a type common in the Orobanchaceae (the so-called deeply reticulate type of Musselman & Mann, 1976) in having the testa with an outer layer of enlarged polygonal cells whose outer walls tend to rupture as the seed reaches maturity, leaving a highly sculptured series of reticulate ridges with deep intervening pits of characteristic morphology (Fig. 2B).

However, *Eremitilla* possesses several autapomorphic morphological characters that are discordant in the Orobanchaceae and require adjustments to the morphological circumscription of the family. Foremost among these, the 5-ribbed ovary and fruit (Figs. 1H, I, 3D) are not known in the family, which normally has a more or less terete gynoecial cross section with at most slight ridging along the septa. Species of Orobanchaceae have a 2(3)-carpellate pistil that has two(three) or four (by deep lobing), usually intrusive, parietal placentae (Cronquist, 1981), whereas in *Eremitilla* there are five intrusive placentae presumably derived from five carpels (Fig. 1J). The alternative hypothesis that the ovary of *Eremitilla* arose through modification (by lobing of intrusive placentae) of a 2-carpellate pistil is plausible, but would require a much more complicated series of structural and developmental changes to have occurred. The 2-carpellate character state in most Orobanchaceae is correlated with the production of 2- or 4-lobed stigmas or of more or less unlobed, crateriform stigmas, whereas the crateriform stigmas in *Eremitilla* have a more or less 5-lobed central pore (Fig. 1H).

The stamens of *Eremitilla* also are unusual in the Orobanchaceae in having the filaments inserted at the base of the ovary and not epipetalous within the corolla tube (Fig. 1H). Anther morphology in the Orobanchaceae is variable, with various shapes and sometimes the production of appendages or spurs, but the condition of having the anthers partially embedded in the expanded filament apex (Figs. 1G, H, 3E) is not known elsewhere in the family. Pantoporate pollen (Fig. 2A), as is found in *Eremitilla*, occurs sporadically in a number of distantly related angiosperm families, but is unknown in Orobanchaceae and within the order Lamiales is characteristic only of *Plantago* L. and related genera (Plantaginaceae). Minkin and Eshbaugh (1989) found that pollen grains of *Boschniakia* C. A. Meyer ex Bongard, *Conopholis* Wallroth, *Epifagus* Nuttall, and *Orobanche* L. sect. *Gymnocaulis* Nuttall are tricolpate with various surface sculpturing. The foveolate exine surface (Fig. 2A) of *Eremitilla* is not unusual in the Orobanchaceae (Type III of Minkin & Eshbaugh, 1989).

In addition, the relatively stout, vesicular trichomes of *Eremitilla* (Figs. 1F, 3E) differ from the pubescence types present in other Orobanchaceae, which consist of slender, short trichomes that often are gland-tipped. Vegetatively, the lack of stomates on the scale leaves separates *Eremitilla* from most other genera of Orobanchaceae (Linsbauer & Ziegenspeck, 1943).

If one accepts *Eremitilla* as an unusual member of the Orobanchaceae, then the construction of hypotheses about relationships with other genera in that family is difficult. Previous molecular studies using the plastid markers *matK* (Young et al., 1999; Young

& dePamphlis, 2005), *rbcL* (Wolfe & dePamphlis, 1998; Young & dePamphlis, 2005), and *rps2* (dePamphlis et al., 1997; Young et al., 1999; Young & dePamphlis, 2005) have shown that holoparasitism has evolved multiple times within the family, but did not provide sufficient resolution to support particular relationships within the group that includes the New World holoparasitic genera. Phylogenetic surveys of the family using the nuclear markers ITS (Wolfe et al., 2005) and *PHYA* (Bennett & Mathews, 2006) gave better resolution within this group, disagreeing in some details but generally supporting a division between *Orobanche* and the other holoparasitic American genera (*Boschniakia* [including *Kopsiopsis* (Beck) Beck], *Conopholis*, and *Epifagus*). Samples of *Eremitilla* tissue dried in silica have been sent for analysis to Gerald Schneeweis (University of Vienna) and to Sarah Mathews (Harvard University) for molecular analysis. Preliminary results from analyses of ITS and *rps2* sequences placed *Eremitilla* at the base of a lineage that includes the other North American holoparasitic genera, but have not been successful in adding resolution concerning intergeneric relationships within the group (Mathews et al., 2008). As with morphological characters, *Eremitilla* appears to possess many autapomorphies in the molecular data sets, leading to its placement on a relatively long branch. Further studies are under way, using additional markers.

Among the holoparasitic genera native in the New World, production of some sort of vegetative body is common, except in the American representatives of *Orobanche*, only a few of which produce such structures (e.g., *O. bulbosa* Beck). However, among the genera producing a discrete vegetative body, the relative size and shape of this structure differ between species. The other North American genera all flower while attached to roots that are much more slender than those infected by *Eremitilla*, thus there may be architectural constraints on the vegetative body in *Eremitilla* that result in the development of a more flattened, rather than globose, vegetative organ (Figs 1A, 3F).

The corollas of *Eremitilla* have much broader tubes and throats than in any of the other ca. 20 New World species of holoparasitic Orobanchaceae (Figs. 1C, 3E). Genera such as *Boschniakia* and *Conopholis* share with *Eremitilla* the character of the upper two corolla lobes more or less fused into a single, often emarginate unit (Figs. 1C, 3E) that frequently is incurved or slightly hooded (vs. usually spreading in *Orobanche* s.l.). Also, as in *Eremitilla*, the corollas in these genera tend to be overall more shallowly lobed (Fig. 1D, E) than in North American *Orobanche*. The corolla tube in *Boschniakia* and *Kopsiopsis* is narrowed and curved above the ovary, similar to the condition of the corollas in *Eremitilla* (Fig. 1E), which, however, has a broader throat than in the other genera. However, the calyces in this group of genera are all strongly gamosepalous, whereas in the new genus the sepals are not coherent basally (Fig. 1D). The calyces in *Orobanche*, on the other hand, usually are divided nearly to the base.

The following key is artificial, rather than synoptic, given the paucity of identifiable morphological synapomorphies that would contribute phylogenetic structure to the clade. The generic classification remains a work in progress, with new data still emerging to suggest that the New World subgenera of *Orobanche* should be classified as segregate genera (Gerald Schneeweis, pers. comm.) and with generic limits to circumscribe monophyletic groups among the remainder of the American genera still tentative.

Key to the Genera of Holoparasitic Orobanchaceae Native in the New World

1a. Ovaries and fruits 5-ribbed, the outer surface muricate. . . . . *Eremitilla*
1b. Ovaries and fruits terete or slightly flattened, not ribbed, the outer surface smooth.
  2a. Calyces deeply 5-lobed; corollas with the upper lip usually moderately to strongly spreading to recurved at anthesis (flowers all chasmogamous).
    3a. Pedicels 4–25 cm, mostly as long as or longer than the flowering stems; flowers 1 to 10 per flowering stem, each with a bract but lacking bracteoles . . . . . *Orobanche* sect. *Gymnocaulis*
    3b. Pedicels absent or to 3(4) cm, when present shorter than the flowering stems; flowers usually numerous, each with a bract and 1 or 2 bracteoles . . . . . *Orobanche* sect. *Nothaphyllon* (A. Gray) Heckard
  2b. Calyces entire along the rim or more commonly with 1 to 5 teeth or lobes, these generally shorter than to about as long as the tube (the tube split longitudinally along one side in *Conopholis* and sometimes with a single long tooth in *Kopsiopsis*); corollas with the upper lip slightly spreading (sometimes in *Kopsiopsis*) or more commonly straight, slightly incurved, or cucullate at anthesis (except in cleistogamous flowers).
    4a. Flowering stems usually well-branched above the base, slender, the flowers widely spaced along the branches; proximal flowers cleistogamous; calyces actinomorphic or nearly so . . . . . *Epifagus*
    4b. Flowering stems usually unbranched, stout, the flowers densely spaced along the axis; cleistogamous flowers absent; calyces zygomorphic.
      5a. Calyces with the tube split deeply longitudinally along the anterior side; flowering stems usually few to several in a dense cluster from the vegetative body; seeds with the outer surface nearly smooth or with a fine network of irregular, sinuous grooves, often appearing roughened or finely and irregularly reticulate-ridged in patches . . . . . *Conopholis*

5b. Calyces often somewhat zygomorphic, but the tube not split longitudinally; flowering stems usually solitary from the vegetative body; seeds with the outer surface prominently reticulate-ridged.
  6a. Corollas with the lower lip shorter than the upper lip or sometimes absent or nearly so, the lobes (when present) to ca. 1 mm long, the upper lip ± incurved to somewhat cucullate; bracteoles absent; anthers strongly exserted; fruits 2-valved; seeds oblong-cylindric; vegetative body with the surface finely granular to nearly smooth . . . . . *Boschniakia*
  6b. Corollas with the lower lip about as long as the upper lip, the lobes 3–5 mm long, the upper lip straight, not cucullate; bracteoles usually present; anthers included or barely exserted; tuft of hair at base of stamen; fruits either 3- or 4-valved; seeds broadly ovoid; vegetative body with the surface divided into polygonal plates. . . . . *Kopsiopsis*

Life history. *Eremitilla mexicana* is a perennial taxon. Presently, nothing is known about seed germination, attachment to the host, or haustorial development in *Eremitilla*. In most other holoparasitic Orobanchaceae, the seeds require host root tips nearby or even in direct contact to promote embryo development and seed germination, and a chemical stimulus (host root exudate) is thought to be necessary to stimulate maturation of the parasite embryo (Kuijt, 1969; Olsen & Olsen, 1979; Baird & Riopel, 1986a, b). During an unspecified period of time after germination (probably several years, based on its woody texture), the subterranean parasite develops an amorphous, somewhat flattened, broadly adherent, vegetative body on the exterior, lateral surface of the more or less horizontal host root (Figs. 1A, 3F). Analogous growths of various shapes, sizes, and textures are produced in some other genera of Orobanchaceae, and have variously been described as tuberous, bulbous, or cormlike, but none of these terms accurately describes the flattened, relatively hardened structures produced in *Eremitilla*. In some other genera of Orobanchaceae, such structures have been called tubercles (Kuijt, 1969; Heide-Jørgensen, 2008), although this term also does not appear to apply accurately to the vegetative body in *Eremitilla*. Anatomical studies have not been performed, but hand-sectioning indicates that this vegetative body includes at least some anomalous growth of host tissue in its interior. There was no indication of any development of roots by the parasite; that is, it is unlikely that the parasite spreads vegetatively to form new infections along a given host root, but that adjacent parasites on the same root apparently represent independent infections. We observed one to four vertical stems of the parasite at different stages of development from a given infection site, as well as the blackened remains (Fig. 3F) of stems from the previous growing season (and in a few cases scars that may represent the emergence points of stems from even earlier years). The elongating stems are sharply pointed at the tip and eventually extend 15–45 cm to reach the soil surface. Because of rocks in the soil, frequently the stems of *Eremitilla* ascend irregularly, with kinks where they bend abruptly around obstructions (Fig. 1A). Toward each stem tip is a zone of dark, sclerotic squamiform leaves (Fig. 1A, B) that presumably functions to protect the immature inflorescence, which shows no sign of differentiation in the material observed until the stem has nearly reached the surface.

The inflorescences of *Eremitilla* are not stalked or only short-stalked above the ground and are orangish brown in overall color, darkening to brown after flowering as the fruits develop and eventually blackening with age (Fig. 3B, C). They blend in very well with the leaf litter. No insects were observed visiting flowering individuals in situ, but excavated stems were visited by small flies, small bees, and a small butterfly on the open roadbank prior to pressing. The stigma is positioned at about the same level but often slightly in front of the anthers of the anterior pair of stamens, which dehisce more or less inward toward the stigma (Figs. 1H, 3E). There is thus the potential of pollen transfer from the adjacent anthers to the stigma, suggesting that the species is at least facultatively inbreeding. There was no evidence of cleistogamous flower production. In the infructescences that we observed, nearly every flower had produced a fruit. Fruit development and ripening require a month or more after flowering (inferred from our field studies). The capsular fruits do not dehisce at maturity, but remain intact within the persistent perianth until ruptured by eventual decay of the infructescence. We observed black, collapsed remains of previous years' infructescences in the field with well-formed seeds still present. In addition to soilborne fungi and bacteria, various insect larvae that tunnel through the stems contribute to the decomposition of the plants.

Seed dispersal in *Eremitilla* is likely to be accomplished by a combination of factors, mainly gravity and water. The bottoms of the steep-walled ravines where the plants grow generally are not subjected to regular wind, especially at ground level. Ants are another possible dispersal agent, as undetermined ants were observed in and around some of the decaying infructescences. As in many other species of Orobanchaceae, the outer layer of the seed coat consists of a layer of enlarged polygonal cells

whose outer facets rupture with age, creating a deeply sculptured surface (Fig. 2B). Olsen and Olsen (1980) suggested that water and hydrostatic charge were the principal agents responsible for dispersal on the morphologically similar seeds of *Boschniakia hookeri* Walpers, as well as their transport into the soil, but could not rule out zoochory as a contributing factor.

Host association. Excavation of the stems of the parasite is difficult in the rocky soils of the habitat. We were surprised to find the attachment to the host root to be relatively deep (to 45 cm), given that the developing flowering stems must push through the rocky soil to reach the surface. Our field studies indicate that the only host plant of *Eremitilla mexicana* is the tree species *Hedyosmum mexicanum* (Chloranthaceae). The parasites were attached exclusively to large (6–10 cm or more diam.) lateral roots (Figs. 1A, 3F) of mature trees and formed a series of individual infections spaced 10 or more cm apart along the lateral surface of the root. In the ravines that we visited, *H. mexicanum* is a slender-trunked canopy tree to ca. 25 m tall with expanded, slightly buttressed bases and gray, finely roughened bark. As with most Chloranthaceae, the plants are resinous, with a distinctive aromatic odor when bruised or otherwise damaged, which facilitates identification of even the roots. Within the region, it is among the first tree species to colonize following clear-cutting or fires and also is present in runoff depressions along the road. However, even though the density of *Hedyosmum* is much greater at such disturbed sites than in the mature primary vegetation of the less impacted ravines, no incidence of parasitism was noted in these younger stands of trees. Parasites were observed attached only to large mature individuals of the host. This is the first report of a vascular plant parasitic on *Hedyosmum*.

Paratypes. MEXICO. **Guerrero:** Mpo. Gral. de Heliodoro de Castillo, 50.5 km ENE of Puerto de Gallo, 9 June 1985, *W. Thomas & J. L. Contreras J. 3762* (FCME, NY); 91 rd. km W of turnoff of Mexico Hwy. 95 Libre & 2.8 rd. km W of village of Tiquimil on dirt rd. to Puerto de Gallo, 24 July 2007, *G. Yatskievych, M. Olson & L. Trejo H. 07-104* (topotype, MEXU, MO); 90 rd. km W of turnoff of Mexico Hwy. 95 Libre & 1.9 rd. km W of village of Tiquimil on dirt rd. to Puerto de Gallo, 13 June 2006, *Yatskievych & Contreras J. 06-45* (FCME, MO), 24 July 2007, *Yatskievych, Olson & Trejo H. 07-106* (MEXU, MO, NY).

Acknowledgments. We greatly appreciate Wayt Thomas's perseverance in seeking a determination for his original collection for over two decades and his kindness in discussing the situation with us. Thanks also are due to Gerald Schneeweis for his role in bringing the original specimen to the authors' attention. FNA co-authors Turner Collins and Alison Colwell provided insightful discussions and encouragement during the study, as did Peter Stevens and Roy Gereau of the Missouri Botanical Garden. Suggestions and corrections made by reviewers Dan Nickrent and Turner Collins, as well as the *Novon* editorial staff, greatly improved the manuscript. Gerald Gastony kindly assisted with the Latin diagnosis. Mark Olson and Laura Trejo Hernández of the MEXU herbarium and UNAM botanical institute provided logistical support for the 2007 fieldwork and excellent field assistance. We appreciate the meticulous skill of John Myers in preparing the plate of illustrations. Pollen samples initially were processed for us by Steven Manchester of the University of Florida. A second set of pollen samples, as well as seeds, were processed by University of Missouri–St. Louis doctoral student Sara Fuentes-Soriano, who also performed the scanning electron microscopy. The SEM work was conducted in the Research Center for Auditory and Visual Studies (funded by NIH grant P30 DC004665) of the Department of Otolaryngology at Washington University in St. Louis. Specimens were collected under permits issued to José Luis Contreras Jiménez and Mark Olson by CONACYT, the Mexican governmental agency responsible for the conservation of biodiversity. Portions of this research were supported financially by the Science and Conservation Division of the Missouri Botanical Garden.

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A New Variety of *Tripterospermum chinense* (Gentianaceae) from Zhejiang Province, Eastern China

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Abstract. The new variety *Tripterospermum chinense* var. *linearifolium* X. F. Jin (Gentianaceae) is described from Zhejiang, eastern China, and distinguished from *T. chinense* (Migo) Harry Smith. Leaf characteristics of both varieties were statistically analyzed, and pollen grain and seed morphology was observed under SEM. SEM results showed that pollen and seed morphology did not differ between the new variety and the autonymic variety. According to the results of statistical analysis, *T. chinense* var. *linearifolium* differs mainly from the autonymic variety in having narrower leaves (3–9 mm vs. 11–43 mm) and solitary flowers (vs. two to five flowers).

Key words: China, Gentianaceae, IUCN Red List, *Tripterospermum*, Zhejiang.

Tripterospermum Blume is widely accepted by taxonomists (Satake, 1951; Liu & Kuo, 1978; Wu, 1984, 1988; Murata, 1989; Ho & Pringle, 1995). The genus comprises 25 species worldwide and is distributed primarily in East and South Asia (Murata, 1989). Nineteen species belonging to two sections are recognized in China, namely section *Platyspermum* C. J. Wu and section *Tripterospermum* (Wu, 1984, 1988). C. B. Clarke (1875) treated the genus *Tripterospermum* in *Crawfurdia* Wallich as a section, and later he changed its rank to subgenus (Wu, 1988). Marquand (1931) reduced *Tripterospermum* and *Crawfurdia* in *Gentiana* as two different sections, but his treatment of some species was confused.

Hul (2002) described three new species from Vietnam. Recently, Fang and Qin (2001) described *Tripterospermum brevilobum* D. Fang as a new species from Guangxi, China, and Chen et al. (2006: 203) described *T. lilungshanense* Chih H. Chen & J. C. Wang (spelled by the authors as "*lilungshanensis*" in the protologue) from Taiwan.

In August 2004, during botanical exploration in Fengyang Mountain of Zhejiang Province, China, we discovered a new variety of *Tripterospermum chinense* (Migo) Harry Smith characterized by narrower leaves and pale purplish white, solitary flowers. A statistical analysis of the leaves was performed on specimens from HHBG, HTC, HZU, and ZM. Twenty-four specimens of *T. chinense* var. *chinense* and nine of the new variety were examined. SPSS Statistics 11.5 (Chicago, Illinois, U.S.A) and SigmaPlot 8.0 (Chicago, Illinois, U.S.A.) software applications were used to analyze and illustrate the leaf variation, respectively (Fig. 1). Mature pollen grains and seeds of the new variety were obtained for SEM observation from type collections *X. F. Jin 808A* (for pollen grains: holotype, HTC) and *X. F. Jin 808C* (for seeds: paratype, HTC). Material of *T. chinense* var. *chinense* was taken from *anonymous s.n.* (for pollen grains, HZU) and *L. X. Hong & B. Y. Ding 1185* (for seeds, HZU), respectively. The seeds and pollen grains were directly observed under a Hitachi S-570 (Tokyo, Japan) scanning electron microscope.

Comparing the morphological characters of the two varieties of *Tripterospermum chinense*, the distinguishing characters were the shape of the cauline leaves (especially leaf width) and the number of flowers. Leaves of *T. chinense* var. *chinense* are ovate or narrowly ovate to ovate-lanceolate, with the base rounded, truncate, or cordate, and are 11–43 mm wide, whereas those of the new variety are linear, with the base cuneate, and are 3–9 mm wide (Fig. 1). Test of significance for leaf width showed a significant difference ($P < 0.01$). Each fertile node of *T. chinense* var. *chinense* is 2- to 5-flowered, while the new variety has solitary flowers at each node. Under SEM, the seeds of the two varieties of *T. chinense* are similar: the shape is oblong, with broad wings on margins, and seed surface ornamentation is finely reticulate, with distinct muri and small lumina with irregular folds. The pollen morphology of the two varieties is also similar in its spheroidal and 3-colporate form with distinct, irregular, and smooth raphes on the surface sculpture. Although pollen and seed morphology are similar, the differences in floral and leaf morphology clearly distinguish the two varieties.

1. Tripterospermum chinense (Migo) Harry Smith, Grana Palynol. 7: 144. 1967. Basionym:

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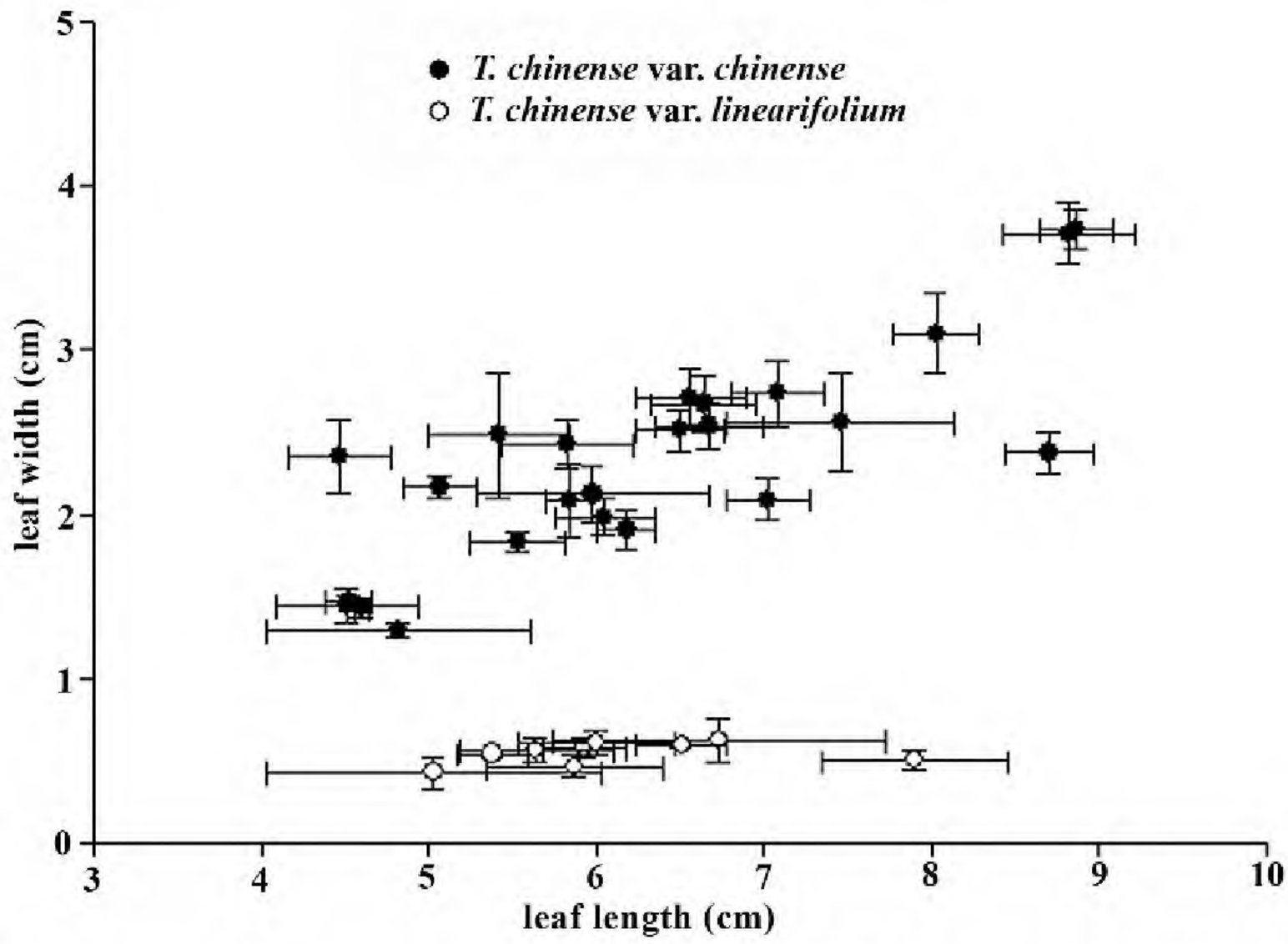

Figure 1. Leaf size variation in *Tripterospermum chinense* var. *chinense* and *T. chinense* var. *linearifolium*, showing mean and standard error (SE) values for each measured specimen.

Crawfurdia chinensis Migo, J. Shanghai Sci. Inst. 3: 154. 1939. TYPE: China. Zhejiang: Lin'an, Changhua, *H. Migo s.n.* (holotype, TI).

1a. Tripterospermum chinense (Migo) Harry Smith var. **chinense**.

1b. Tripterospermum chinense (Migo) Harry Smith var. **linearifolium** X. F. Jin, var. nov. TYPE: China. Zhejiang: Longquan, Mt. Fengyang, under forests, 1650 m, flowers pale purple, 26 Aug. 2004, *X. F. Jin 808A* (holotype, HTC; isotypes, MO, ZM). Figure 2.

Haec varietas a *Tripterospermo chinensi* (Migo) Harry Smith var. *chinensi* foliis caulinis linearibus (vs. ovatis, anguste ovatis vel ovato-lanceolatis), 3–9 mm (vs. 11–43 mm) latis, basi cuneatis (vs. rotundis, truncatis vel cordatis) atque floribus solitariis (vs. 2 ad 5) differt.

Perennial herb; stems terete, twining, green or brown. Basal leaves in 2 pairs, nearly prostrate, sessile, papyraceous, ovate, obovate, or rounded, 1.2–5 × 1–3 cm, apex acute, base cuneate or broadly cuneate, margin entire, dark green on adaxial surface, sometimes with yellowish green spots, pale green on abaxial surface; cauline leaves linear, membranaceous, 5–10 × 0.3–0.9 cm, base cuneate, margin entire, apex acuminate to caudate; veins 3; petiole 0.2–0.3 mm. Inflorescences axillary, with solitary flower per node; pedicel very short, 1–2 mm, with 1 or 2 pairs of bracts, linear, herbaceous, 3–4 mm. Calyx campanulate, 1.5–1.8 cm; tube 8–9 mm, wingless; lobes linear-lanceolate, 6–9 mm; corolla pale purplish white, with opalescent plicae; tube narrowly campanulate, 3–3.5 cm; corolla lobes triangular-ovate, 4–5 × 3–4 mm, apex acuminate; plicae semiorbicular, ca. 5 × 3 mm; filaments linear, 1.5–1.7 cm; anthers ovoid, ca. 1.5 mm; ovary elliptic-lanceolate, attenuate on both sides, ca. 2.5 cm, with a long stipe to 10 mm long; style linear, 9–11 mm; stigma persistent, ca. 1 mm. Capsules ellipsoid, compressed, 2.5–2.7 cm × 3–4 mm, included in corolla; seeds brown, orbicular, compressed, ca. 2 mm diam.; wings discoid.

Habitat and distribution. *Tripterospermum chinense* var. *linearifolium* is known currently only from its type locality, on Mt. Fengyang and Mt. Jiulong, southern Zhejiang Province, eastern China. It grows in forests of *Fokienia hodginsii* A. Henry & H. H. Thomas and *Pseudotaxus chienii* (W. C. Cheng) W. C. Cheng at ca. 1650 m in elevation.

IUCN Red List Category. According to IUCN Red List categories and criteria (IUCN, 2001), the new variety should be considered Near Threatened (NT), and there is a need for its future conservation. *Tripterospermum chinense* var. *linearifolium* grows on Mt. Fengyang and Mt. Jiulong, two natural reserves of China, and its habitats are well preserved. However, its area of distribution is less than 10,000 km^2 and the population is less than 5000 individuals.

Phenology. The new variety was collected in flower and fruit from July to August.

Paratypes. CHINA. **Zhejiang:** Longquan, Mt. Fengyang, 1650 m, 26 Aug. 2004, *X. F. Jin 808B*, *808C* (HTC), 21 July

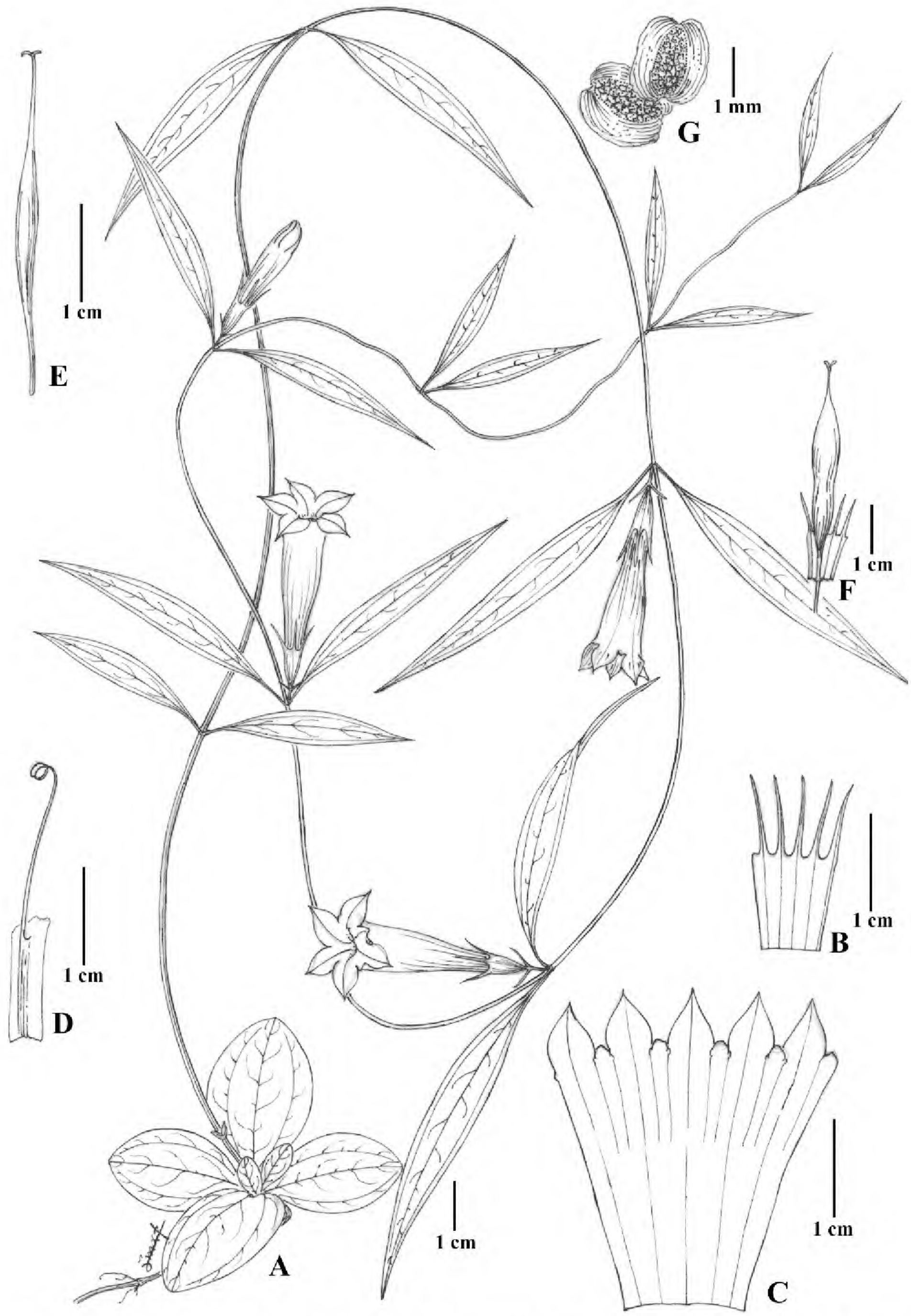

Figure 2. *Tripterospermum chinense* var. *linearifolium* X. F. Jin. —A. Habit. —B. Calyx. —C. Corolla. —D. Filament and anther. —E. Ovary, style, and stigma. —F. Capsule. —G. Seed. Drawn by Xiao-Feng Jin. A–E from the holotype *X. F. Jin 808A* (HTC); F, G from the paratype *X. F. Jin 808C* (HTC).

1972, *Zhejiang Med. Bot. Exped. s.n.* (HTC); Suichang, Mt. Jiulong, Zhongkeng, 15 Aug. 1985, *F. G. Zhang, M. H. Wu & Z. Y. Li 4406* (HTC).

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Weberbauera arequipa (Brassicaceae), a New Species from Peru

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Abstract. *Weberbauera arequipa* Al-Shehbaz & Montesinos (Brassicaceae), a new species from Peru, is described and illustrated. It is distinguished from the other species of *Weberbauera* Gilg & Muschler by having ebracteate racemes, persistent sepals and petals, 4-seeded fruits, and a few simple trichomes restricted to the petiolar bases. It is closely related to the Bolivian *W. retropila* Al-Shehbaz, but differs by the lack of branched trichomes and by having glabrous fruits, smaller flowers, and persistent petals. The IUCN status of the new species is determined as Data Deficient (DD).

Key words: Brassicaceae, IUCN Red List, Peru, *Weberbauera*.

Gilg and Muschler (1909) established *Weberbauera* Gilg & Muschler (Brassicaceae) as a monotypic genus based on a species they described from Peru as *W. densiflora* Gilg & Muschler. Schulz (1924) recognized two species in the genus and reduced the above to synonymy of *W. spathulifolia* (A. Gray) O. E. Schulz. Macbride (1934) expanded the limits of *Weberbauera* by the transfer of the type species of two monospecific genera, *Alpaminia* O. E. Schulz and *Pelagatia* O. E. Schulz. Al-Shehbaz (1990a) further expanded the genus by the discovery of five new species and by the transfer of six previously placed in *Stenodraba* O. E. Schulz. Several species have since been added to *Weberbauera* (Al-Shehbaz, 1990b, 2004) and, as presently stands, the genus consists of 23 species, including the novelty below, *W. arequipa* Al-Shehbaz & Montesinos. The new species was discovered during the 2005–2006 fieldwork in the Peruvian departments of Arequipa and Moquegua by the second author (D.B.M.) as part of his research toward the bachelor degree at Universidad Católica de Santa María, Arequipa.

Weberbauera arequipa Al-Shehbaz & Montesinos, sp. nov. TYPE: Peru. Arequipa: Arequipa Prov., Distr. San Juan de Tarucani, Tico Tico, 16°06′30″S, 70°59′16″W, riverbed, 4181 m, 3 Apr. 2006, *D. B. Montesinos & L. P. Mondragón 936* (holotype, WAG; isotypes, MO, USM). Figure 1.

Herba annua ca. 6 cm alta, glabra. Folia caulina oblanceolata, 8–12 × 3–5 mm, petiolata, dentata, petiolis ad basim ciliata. Racemi ebracteati; pedicelli fructiferi divaricati, 2–4(–5) mm longi, glabri, recti. Sepala oblonga, 1.1–1.3 × 0.6–0.8 mm, glabra; petala alba, anguste obovata, 1.8–2 × 0.7–0.9 mm; ovula 4. Fructus oblongus vel lanceolatus, 5–7 × 1.3–1.6 mm, stylo 0.3–0.5 mm longo coronatus; semina oblonga, uniseriata, 1.3–1.6 × 0.9–1 mm, cotyledonibus incumbentibus.

Herbs annual, ca. 6 cm tall; trichomes absent except a few simple ones at base of petioles; stems decumbent, glabrous, several branched above base. Cauline leaves oblanceolate, petiolate, 8–12 × 3–5 mm, petioles 2–4 mm, blade glabrous, base attenuate, margin dentate. Racemes ebracteate, elongated slightly in fruit; rachis straight. Sepals green, oblong, 1.1–1.3 × 0.6–0.8 mm, glabrous, membranous at margin, not saccate at base; petals white, narrowly obovate, 1.8–2 × 0.7–0.9 mm, not clawed; filaments white, 1–1.5 mm; anthers ovate, ca. 0.4 mm; ovules 4

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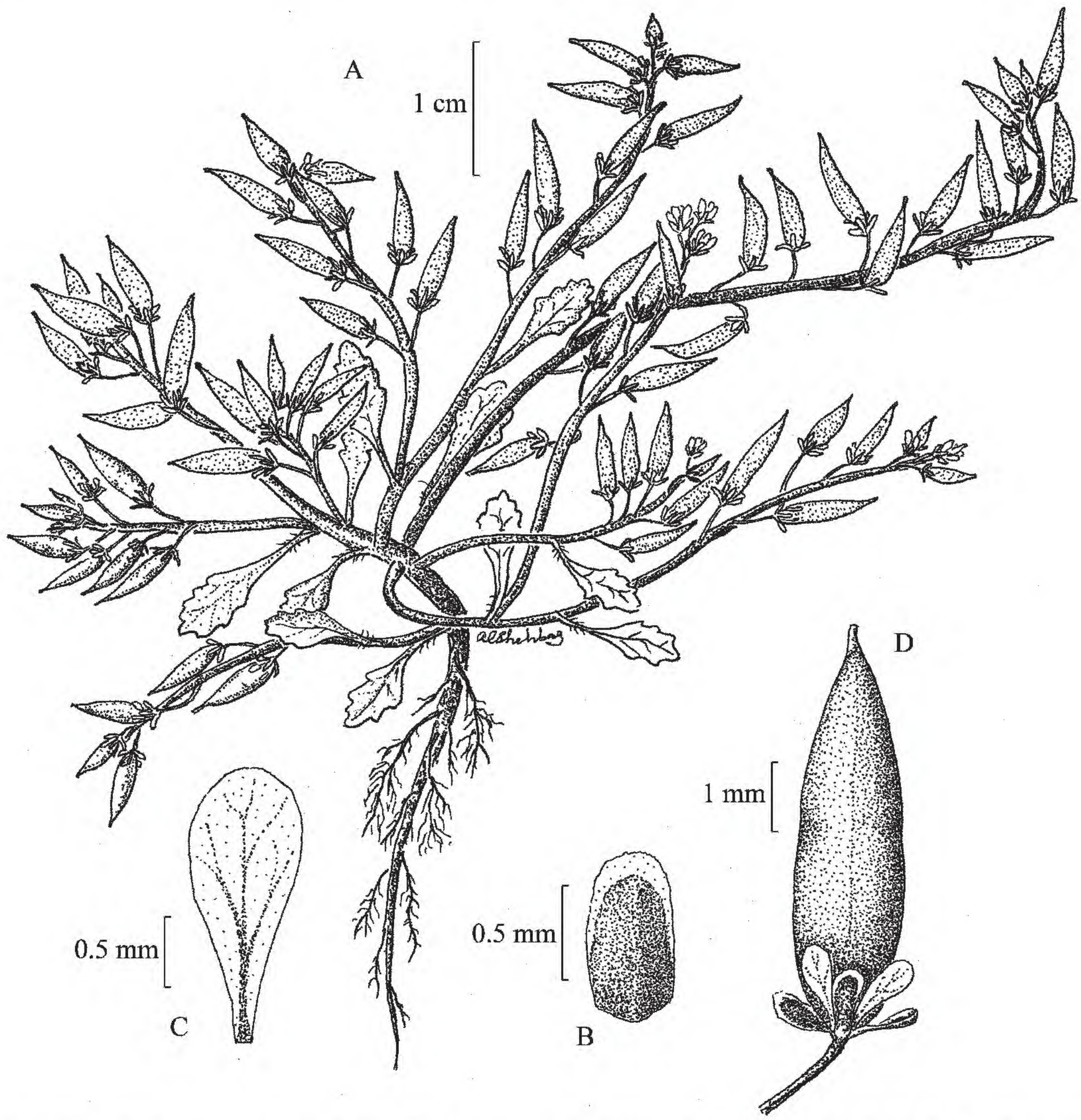

Figure 1. *Weberbauera arequipa* Al-Shehbaz & Montesinos. —A. Fruiting plant. —B. Sepal. —C. Petal. —D. Fruit with fruiting pedicel and persistent sepals and petals. Drawn from the holotype *Montesinos & Mondragón 936* (WAG).

per ovary. Fruiting pedicels mostly divaricate, 2–4(–5) mm, straight, slender; fruits oblong to lanceolate, 5–7 × 1.3–1.6 mm, not torulose, straight; valves with an obscure midvein, glabrous; style 0.3–0.5 mm; stigma entire. Seeds dark brown, oblong, uniseriate, 1.3–1.6 × 0.9–1 mm; cotyledons incumbent.

Distribution and IUCN Red List category. *Weberbauera arequipa* grows at riverbeds in grasslands, together with *Jarava ichu* Ruiz & Pavón, *Werneria pygmophylla* S. F. Blake, *Azorella compacta* Philippi, and *Perezia multiflora* Lessing. It is known thus far only from the type locality and appears to be extremely rare. However, its IUCN Red List category (IUCN, 2001) is determined as Data Deficient (DD).

Etymology. The species epithet *arequipa*, named after the Peruvian department and province Arequipa, is a noun used in apposition and, therefore, should be maintained according to Article 23.5 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006).

Discussion. The new species is readily distinguished from the other species of *Weberbauera* by its ebracteate racemes, persistent sepals and petals, 4-seeded fruits, and few simple trichomes restricted to the petiolar bases. It is related to the Bolivian endemic *W. retropila* Al-Shehbaz but differs by the absence (vs. presence) of branched trichomes and by having glabrous (vs. retrorsely pubescent), 4- (vs. 6 or 8)-seeded fruits, glabrous (vs. sparsely pubescent) leaf

surfaces, smaller flowers (sepals 1.1–1.3 mm vs. 2–2.5 mm long, petals 1.8–2 mm vs. 3–3.5 mm long), and persistent (vs. caducous) petals.

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Physaria okanensis (Brassicaceae), a New Species from Catamarca, Argentina

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ABSTRACT. *Physaria okanensis* Al-Shehbaz & Prina (Brassicaceae), a new species from Catamarca, Argentina, is described and illustrated. It is distinguished from the five other South American species of *Physaria* (Nuttall) A. Gray by its densely pulvinate habit and few-flowered scapes. It resembles the non-pulvinate, often non-scapose *P. pygmaea* O'Kane & Al-Shehbaz, but also differs by having longer petals and larger, orbicular (vs. ovoid) fruits. The IUCN status of the new species is determined as Data Deficient (DD).

Key words: Argentina, Brassicaceae, Catamarca, IUCN Red List, *Physaria*.

Physaria (Nuttall) A. Gray (ca. 90 species) is a primarily North American genus, and only five species are disjunctly distributed in Argentina and neighboring Bolivia (O'Kane & Al-Shehbaz, 2004). Taxonomic limits of the genus have recently been expanded to include *Lesquerella* S. Watson, and for a detailed discussion and references, the interested reader should consult Al-Shehbaz and O'Kane (2002). A single species, *L. mendocina* (Philippi) Kurtz, was previously thought to grow in South America (Boelcke, 1967; Boelcke & Romanczuk, 1984). However, with a better understanding of the character variation in the genus and substantial fieldwork, the number of species is likely to be more than six, including the novelty below.

The new species was discovered by the authors during their separate visits to the herbarium of Fundación Miguel Lillo (LIL) in San Miguel de Tucumán, Argentina.

Physaria okanensis Al-Shehbaz & Prina, sp. nov. TYPE: Argentina. Catamarca: al norte del Cerro El Manchao, 4000 m, 27 Oct. 1979, *Stephan Haloy A. 809* (holotype, LIL 574675; isotype, MO [LIL fragm.]). Figure 1.

Herba perennis pulvinata scaposa 10–30 cm diam., dense argenteo-pubescens, caudice crasso lignoso multiramoso. Folia basalia rosulata, petiolata, integra, oblanceolata; folia caulina nulla. Racemi 2- vel 3-flori; pedicelli fructiferi recti, 7–10 mm longi. Petala lutea, spathulata, 7–8 mm longa; ovula 10 ad 12. Fructus orbiculares, angustiseptati, 8–10 × 8–10 mm, stylo tenui 3.5–4 mm longo coronato; semina compressa, ovata, exalata, ca. 2.5 × 1.5 mm.

Pulvinate, scapose perennials with cushions 10–30 cm diam., densely silvery pubescent throughout; trichomes sessile, stellate, 0.08–0.13 mm diam., not webbed, with 16 to 22 ultimate branches; caudex thick, woody, with numerous branches covered with leaf remains of previous years; stems erect, simple, 0.7–1.2 cm. Basal leaves rosulate; petiole 4–6 mm, expanded to a base 1.5–2 mm wide; leaf blade oblanceolate, 5–8 × 1.5–2 mm, base attenuate, margin entire, apex obtuse; cauline leaves absent. Racemes 2- or 3-flowered, ebracteate, scarcely elongated in fruit. Sepals oblong, ascending, 4.5–5 × 1–1.2 mm, not saccate at base, silvery pubescent, caducous; petals yellow, spatulate, 7–8 × 1.5–2 mm; filaments 3.5–4 mm; anthers narrowly oblong, 1–1.2 mm; ovules 10 to 12 per ovary. Fruiting pedicels slender, straight, ascending-divaricate, 7–10 mm; fruit orbicular, angustiseptate, 8–10 × 8–10 mm, moderately pubescent, sessile, obtuse at base, slightly emarginate at apex; replum 2.5–3 mm wide; septum perforate; style slender, 3.5–4 mm; stigma wider than style; seeds compressed, ovate, wingless, ca. 2.5 × 1.5 mm; cotyledons accumbent.

Distribution and IUCN Red List category. The new species is known only from the type specimen and appears to be extremely rare, as evidenced from the numerous Argentinean collections of other *Physaria* species examined by the authors. Therefore, its IUCN Red List category (IUCN, 2001) remains uncertain, with its current assessment as Data Deficient (DD).

Etymology. *Physaria okanensis* is named in honor of Steve L. O'Kane Jr., a world authority on the genus *Physaria*.

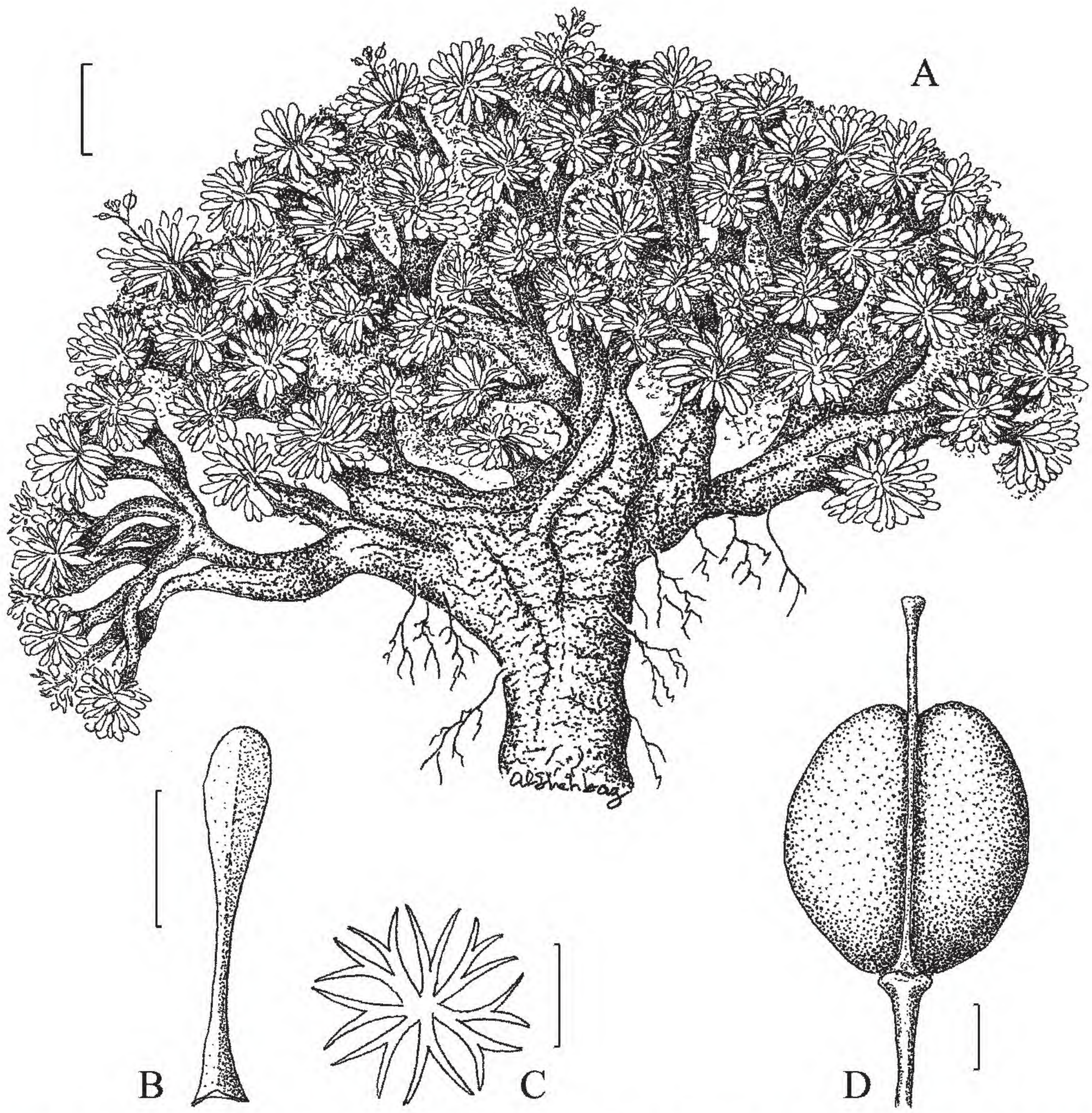

Figure 1. *Physaria okanensis* Al-Shehbaz & Prina. —A. Plant. —B. Leaf. —C. Leaf trichome. —D. Fruit (trichomes not drawn). Scale bars: A = 1 cm; B = 5 mm; C = 0.08 mm; D = 1 mm. Drawn by Al-Shehbaz from the holotype, *Haloy 809* (LIL).

Discussion. The new species is readily distinguished from five other South American species of *Physaria* by forming large cushions 10–30 cm diam. and by producing few-flowered, ebracteate scapes. The other species are non-pulvinate and produce leafy flowering stems, although *P. pygmaea* O'Kane & Al-Shehbaz is occasionally scapose. *Physaria okanensis* and *P. pygmaea* are similar in having few-flowered racemes, but differ by having petiolate (vs. sessile) leaves, longer petals (7–8 mm vs. 4–5[–6] mm), and larger fruits that are 8–10 × 8–10 mm (vs. 4–5[–8] × 3–4[–5] mm) and orbicular (vs. ovoid).

Acknowledgments. We are grateful to Roberto Kiesling for his review and Victoria C. Hollowell for the editorial advice. Fieldwork and herbarium studies were generously supported by the National Geographic Society (grant 8139-06).

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A New Species of *Meconopsis* (Papaveraceae) from Gansu, China

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ABSTRACT. A new species of *Meconopsis* Viguier, *M. biloba* L. Z. An, Shu-Yan Chen & Y. S. Lian (Papaveraceae), from Gansu Province, China, is described and illustrated. The new species is related to *M. quintuplinervia* Regel by several similar characters, including the basal leaf rosettes, a solitary flower borne on the scape, and the blue petals and filaments. It differs from all known *Meconopsis* species in China in its bilobed petals.

Key words: China, IUCN Red List, *Meconopsis*, Papaveraceae.

The genus *Meconopsis* Viguier was established with *M. cambrica* Viguier in 1814 (Fedde, 1936), and the genus currently includes 49 species (Wu & Chuang, 1980). Only one species is native to western Europe, and the remaining 48 species are distributed in the China–Himalayan region of eastern Asia, with 38 species in China. Western China and its neighboring Himalayan regions represent the center of distribution for the genus (Wu & Chuang, 1980; Wu, 1999). During floristic investigation of Lianhua Shan in Lingtan County of Gansu Province, China, we encountered a new species of *Meconopsis* with striking flowers. We describe this species on the basis of fresh material. The new species has basal leaf rosettes, one scape with a solitary flower, four blue petals, and blue filaments. It stands apart from related species by its petals that are 1/3 to 1/2 bifid at the apex.

Meconopsis biloba L. Z. An, Shu-Yan Chen & Y. S. Lian, sp. nov. TYPE: China. Gansu: Lingtan County, Lianhua Shan, 3050 m, screes and rocky slopes, 24 July 2004, *L. Z. An 2047243* (holotype, LZU). Figure 1.

Species haec *Meconopsidi quintuplinerviae* Regel affinis, a qua (etiam ab omnibus congeneris sinensibus) petalis manifeste bilobis bene differt.

Perennial herb, ca. 30–50 cm tall, covered at base by persistent leaf bases, densely pubescent with brown and short branched hairs. Leaves entire, forming a basal rosette; petioles 5–9 cm; leaf blades oblong, ovate, rectangular, or rounded-ovate, 3–8 × 1.5–3 cm, blunt at apex, broadly cuneate at base, attenuate along petioles, both surfaces pubescent with yellow or brown, short branched hairs, with 3 to 5 visible longitudinal veins. Scape 1 per rosette, pubescent with brown, branched, and inflexed hairs. Flower solitary, slightly pendant; sepals 2, caducous; petals 4, blue, 3–4 × 2.5–3.5 cm, obovate or subrotund, 1/3 to 1/2 bifid at apex; stamens with blue filaments, 1.5–2 cm; anthers pale yellow, oblong, 1–1.5 mm; ovary subglobose, 5–8 mm, densely pubescent with brown and short branched hairs; style short, 1–1.5 mm; stigma capitate, 4-partite. Capsule formed by 4 carpels. Seeds not seen.

Distribution and habitat. The new species is known only from the type specimen collected from Lianhua Shan in Lingtan County of Gansu Province, China, growing at an altitude of 3050 m on screes and rocky slopes.

IUCN Red List category. Due to the lack of information regarding the ecology, life history, and population density of the species, as well as the frequency of fire in Lianhua Shan, *Meconopsis biloba* should be classified as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Discussion. This species is affined with *Meconopsis quintuplinervia* in several characters, including the basal leaf rosettes, the solitary flower borne on the scape, and the blue petals and filaments. They differ in the petals, which are entire in *M. quintuplinervia* and bilobed in the new species. This character is extremely unusual in *Meconopsis* and therefore allows *M. biloba* to be easily distinguished from other species in the genus.

The first author visited the original collection site in July 2007, but was unable to collect paratypes because the collection site was inaccessible. There were nine other plants observed at the type locality

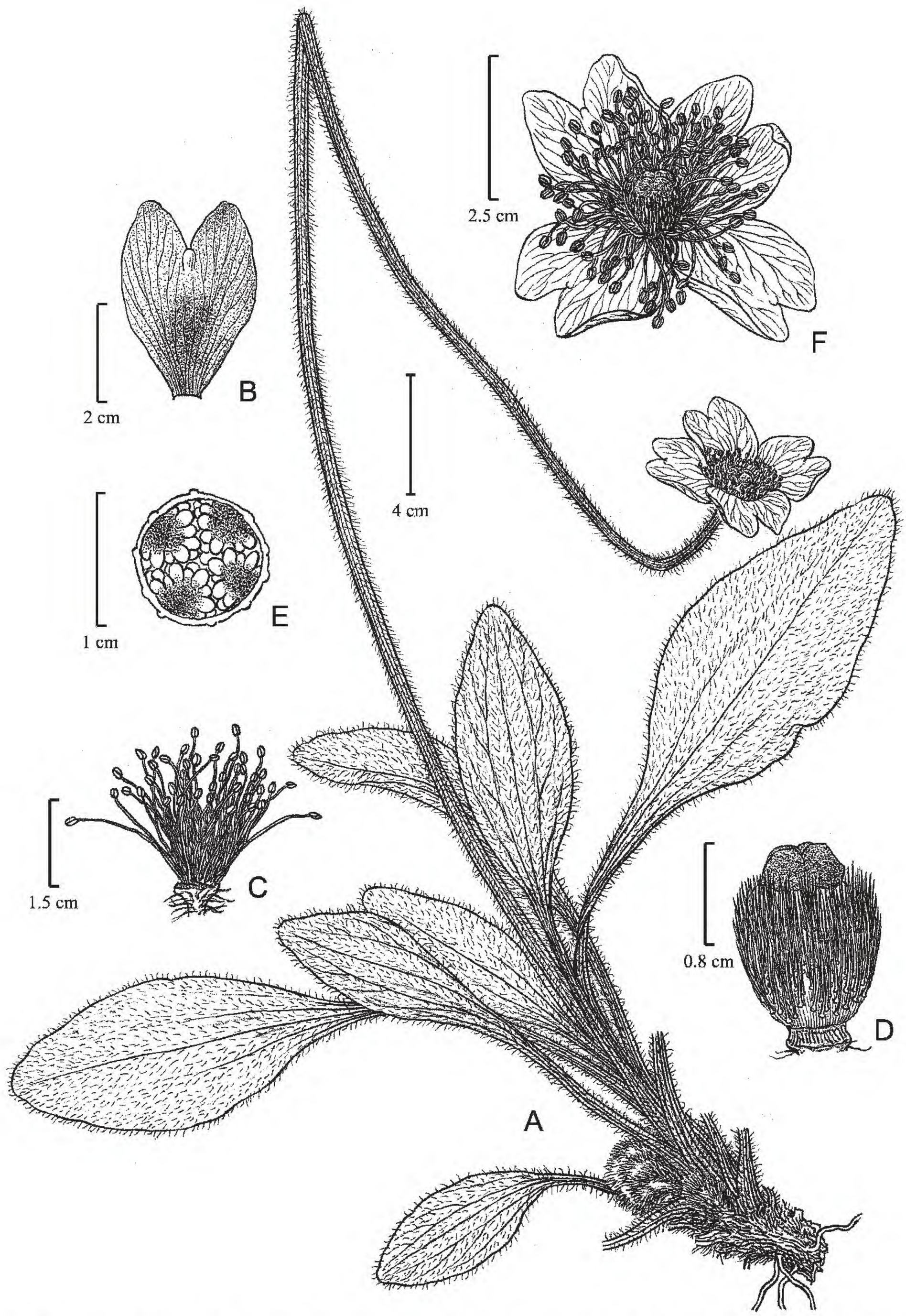

Figure 1. *Meconopsis biloba* L. Z. An, Shu-Yan Chen & Y. S. Lian. —A. Habit. —B. Petal —C. Stamen. —D. Pistil. —E. Part of ovary, cross section. —F. Flower. Drawn from the holotype *L. Z. An 2047243* (LZU).

where the holotype was collected. The new species is not under cultivation at LZU.

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Two New Species of *Dombeya* (Malvaceae) from Madagascar

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Abstract. Two new Malagasy species of *Dombeya* Cavanilles subgen. *Xeropetalum* (Delile) K. Schumann (Malvaceae) are described. *Dombeya asymmetrica* Applequist is native to Mananara-Nord in northeastern Madagascar, and *D. rienanensis* Applequist to the Matatana River basin. *Dombeya rienanensis* is placed within subseries *Trohy* Arènes. *Dombeya asymmetrica* is tentatively placed within subseries *Repandae* Arènes; the species is distinguished by its long, narrow lanceolate leaves with asymmetrical apices.

Résumé. Deux nouvelles espèces malgaches de *Dombeya* Cavanilles subgen. *Xeropetalum* (Delile) K. Schumann (Malvaceae) sont décrites. *Dombeya asymmetrica* Applequist est originaire de la région de Mananara-Nord au nord-est de Madagascar, et *D. rienanensis* Applequist du bassin du Matatana. *Dombeya rienanensis* est classée en subseries *Trohy* Arènes. *Dombeya asymmetrica* est classée provisoirement en subseries *Repandae* Arènes; l'espèce est caractérisée par ses feuilles longues, étroitement lancéolées, avec un apex asymétrique.

Key words: *Dombeya*, IUCN Red List, Madagascar, Malvaceae.

Dombeya Cavanilles is one of the larger genera of Malvaceae s.l. (formerly Sterculiaceae; cf. Bayer et al., 1999), with over 200 species recognized, and is an important component of the Malagasy flora. The last complete revision of *Dombeya* in Madagascar and the Comores recognized 187 species (Arènes, 1958, 1959) in two well-distinguished subgenera, whereas 19 species are recognized in Africa (Seyani, 1991), with one extending to Arabia, and 14 inhabit the Mascarenes (Friedmann, 1987). Since the publication of Arènes' (1959) treatment, further taxonomic efforts related to the Malagasy species of *Dombeya* have been limited (Barnett & Dorr, 1986; Dorr, 2001). Examination of herbarium specimens at P has led to the discovery of two specimens not referable to previously described species, both of which are herein described as new. Both species are native to humid forests of eastern or northeastern Madagascar; their provisional conservation status according to IUCN Red List criteria (IUCN, 2001) must be described as Data Deficient (DD), since virtually nothing is known of their ranges or population size.

1. Dombeya asymmetrica Applequist, sp. nov. TYPE: Madagascar. Prov. Toamasina: forêt d'Ibanda (NW Antanambe), Mananara-Nord, [16°23′S, 049°44′E?], 22 Feb. 1990 (fl.), *Raharimalala 190* (holotype, P). Figure 1.

Frutex usque ad 6 m altus; ramuli novelli confertim lepidoti. Folia petiolus 7–10 mm longus confertim lepidotus; lamina lanceolata basi cuneata vel rotundato-cuneata apice asymmetrice acuminata, 8–17.5 cm longa et 1.6–3.9 cm lata, infra sparsim lepidota supra sparsim lepidota vel glabra, venatione camptodroma tenui. Inflorescentia pauciflora pedunculo sparsim lepidoto usque ad 4.5 cm longo insidens; bracteae lanceolatae ca. 3 mm longae basaliter dilatatae confertim lepidotae; pedicelli 6–8 mm longi confertim lepidoti. Sepala 5, 5–6.5 mm longa basaliter connata lepidota plerumque non reflexa; petala 5 late obovata, 6.5–7 mm longa et ca. 5 mm lata, alba; stamina ca. 10 basaliter connata faciens coronam brevem, filamentis (1–)1.5–2(–2.5) mm longis, antheris anguste oblongis; staminodia linearia ca. 3 mm longa excedentia stamina fertilia; gynoecium 3-carpellare, ovario lepidoto, stylo 3–3.5 mm longo basaliter lepidoto ramis 1–1.3 mm longis.

Shrub 6 m high; small twigs densely lepidote with fringed scales. Leaves lanceolate, 8–17.5 × 1.6–3.9 cm; petiole 7–10 mm, densely lepidote; base cuneate or occasionally rounded; apex usually asymmetrically acuminate; venation pinnate, camptodromous, secondary veins numerous, narrow and inconspicuous especially on adaxial surface; both surfaces very sparsely lepidote, with scales mostly near midrib, sometimes becoming glabrous on adaxial surface. Inflorescences with very few flowers, on slender peduncles to 4.5 cm long; peduncle and rachis lepidote; floral bracts ca. 3 mm, lanceolate, widening at the base, densely lepidote; pedicels 6–8 mm, densely lepidote. Sepals 5, ca. 5–6.5 mm, fused basally, densely lepidote, the lobes not reflexed; petals 5, white, 6.5–7 mm, ca. 5 mm broad, broadly obovate, margins asymmetrically curved inward; stamens ca. 10, basally fused into a short corona; filaments (1–)1.5–2(–2.5) mm long, unequal; anthers narrowly oblong, 1–1.3 mm; staminodes linear, ca. 3 mm, longer than fertile stamens; gynoecium 3-

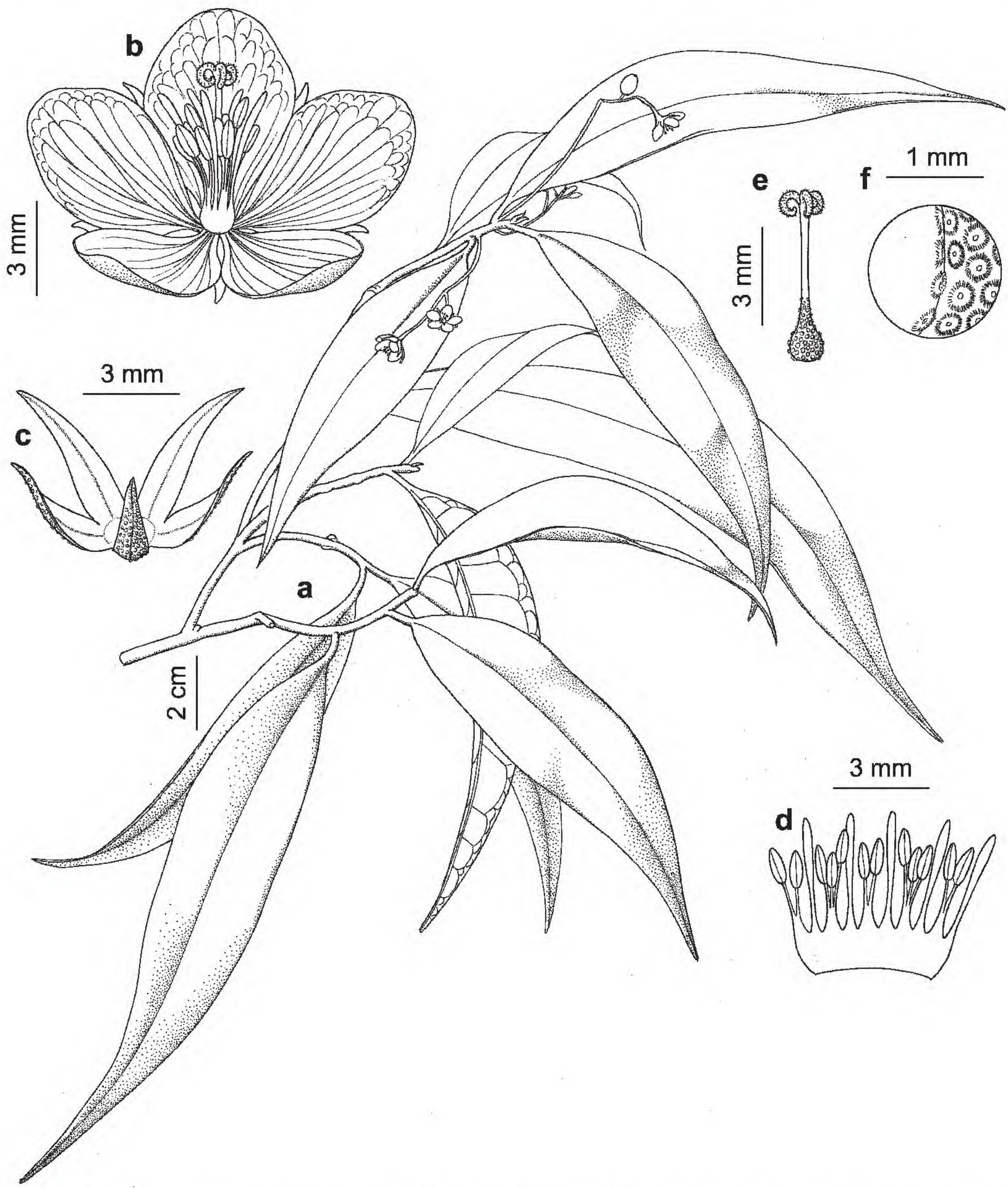

Figure 1. *Dombeya asymmetrica* Applequist. —A. Flowering branch. —B. Flower. —C. Calyx. —D. Androecium. —E. Gynoecium. —F. Lepidote scales of gynoecium. A–F drawn from the type, *Raharimalala 190* (P).

carpellate; ovary lepidote; stylar column 3–3.5 mm, basally lepidote, with 3 curled branches 1–1.3 mm long. Fruit unknown.

Habitat and distribution. The holotype is apparently from coastal forest or humid forest near the coast in northeastern Madagascar in the region of Mananara-Nord.

Phenology. Flowers have been collected in February.

Vernacular name. Rondrôo (rondro).

Discussion. The holotype specimen of *Dombeya asymmetrica* is remarkable for its long, narrowly lanceolate leaves with more or less asymmetrically acuminate apices; this leaf shape is virtually unknown in *Dombeya*, despite the exceptional range of variation within the genus. The species belongs to subgenus *Xeropetalum* (Delile) K. Schumann, which is characterized by gynoecia with fewer than five carpels. The

inflorescences of the only known specimen are very small and in poor condition. One appears to have been a reduced cyme with at least three buds, which, following Arènes' (1958, 1959) classification, would place it in section *Xeropetalum*. However, the possibility that other specimens might be keyed out to section *Decastemon* Planchon (umbellate, geminate or solitary flowers), perhaps even correctly so, cannot be discounted. Section *Decastemon*, a distinctive and probably monophyletic group, frequently has lanceolate leaves and slender, few-flowered inflorescences, as does this species. On the other hand, lepidote pedicels and sepals, such as are seen in *D. asymmetrica*, represent a very rare character in section *Decastemon*, which most often has glabrous and glandular, or occasionally stellate-pubescent, sepals. The species is tentatively placed in section *Xeropetalum* because of the apparently cymose inflorescence and lepidote indument, but the collection of more and better material would be highly desirable.

Once referred to section *Xeropetalum*, *Dombeya asymmetrica* is placed by Arènes' (1958, 1959) classification within subsection *Floribundae* Arènes (leaves bearing small scales not totally covering the surface), series *Epilosae* Arènes (ovary lepidote), subseries *Repandae* Arènes (sepals not reflexed), and would be identified by his key as *D. sahatavyensis* Arènes. As discussed below, Arènes' complex infrageneric classification, with many subgroups defined by single characters that vary repeatedly, probably includes many nonmonophyletic subgroups; thus, even if the inflorescences of *D. asymmetrica* are correctly interpreted, the predictive value of placement within subseries *Repandae* is unclear. *Dombeya asymmetrica* can be differentiated from all currently recognized species in subseries *Repandae* by its distinctive leaf shape and its small, slender inflorescences with only one order of branching; in fact, almost all species of section *Xeropetalum* normally have better developed inflorescences. Though the leaves of *D. sahatavyensis* are sometimes asymmetrical, they never have acuminate apices; *D. asymmetrica* also has shorter petioles and smaller flower parts, including petals, staminodes, and styles (though this must be interpreted with caution given the possibly poor condition of the holotype). Within subseries *Repandae*, *D. asymmetrica* should also be distinguished in particular from the widespread *D. laurifolia* (Bojer) Baillon, which has leaves that are highly variable but normally not lanceolate (being usually widest above the midpoint), asymmetrical, acuminate, or exceeding 13.5 cm long.

If a specimen of *Dombeya asymmetrica* were keyed out as belonging to section *Decastemon*, it would be identified as belonging to subsection *Decantherae* Arènes (peduncles longer than pedicels), series *Lepidotae* Arènes (ovaries lepidote), which is presently a monotypic series including only *D. capuroniana* Arènes. That species has long narrow leaves, but the leaves are oblanceolate to oblong or elliptical, with acute, often shallowly toothed, more or less symmetrical apices. *Dombeya asymmetrica* is also distinguished by its flowers, which may be slightly smaller and are of different conformation (anthers oblong and at least 1 mm long vs. oval and less than 1 mm; style 3–3.5 mm long with short branches vs. about 1.5 mm long with branches to 4 mm long). The leaf shape and lepidote reproductive indument suffice to distinguish *D. asymmetrica* from all currently recognized species in section *Decastemon*.

2. Dombeya rienanensis Applequist, sp. nov. TYPE: Madagascar. Prov. Fianarantsoa: haute vallée de la Rienana (bassin du Matitanana [= Matatana]), [22°14′S, 047°07′E], forêts, 1000–1400 m, 18–22 Nov. 1924 (fl.), *Humbert 3524* (holotype, P). Figure 2.

Haec species a *Dombeya gracilicyma* Arènes stipulis longioribus longiacuminatis, inflorescentiis minoribus saepe umbelliformibus, pedicellis brevioribus, corona staminali breviore, petalis minoribus, staminibus numerosioribus atque stylo breviore differt.

Tree; twigs grayish to tan, lepidote when young. Leaves obovate to oblanceolate, 4.5–9.2 × 2.1–4.3 cm; petiole 5–13 mm, densely lepidote; base cuneate to rounded-cuneate; apex ± rounded, occasionally slightly emarginate or cuspidate; margins entire to very slightly undulate; venation pinnate, camptodromous, secondary veins 5 to 8(to 9) pairs, alternate in middle portion of leaf, sometimes pale; both surfaces lepidote with small scales, often sparsely so in larger leaves especially on the adaxial surface; stipules awl-shaped with a broadened base, 4–6 mm, lepidote, ± caducous. Inflorescences few-flowered cymes, often umbelliform, lateral, borne near twig apices; peduncles 1.4–2.6 cm; inflorescence bracts 2–4 mm, lanceolate, caducous; pedicels ± angular, articulated, 5–9(–12) mm; floral bracts 3, borne slightly below base of flower, deltoid, 1.5–2 mm, caducous; inflorescences lepidote throughout. Sepals narrowly lanceolate, 4.8–7 mm, lepidote, mostly reflexed after anthesis, short-connate at immediate base and the adaxial surface of fused portion bearing small patches of pale, possibly glandular tissue; petals white, 6.2–8 × 3.2–4.5 mm, obovate to obdeltoid with asymmetrical apex; androecial corona 1.2–1.6 mm; fertile stamens oppositipetalous, 20(to 25), in groups of 4(to

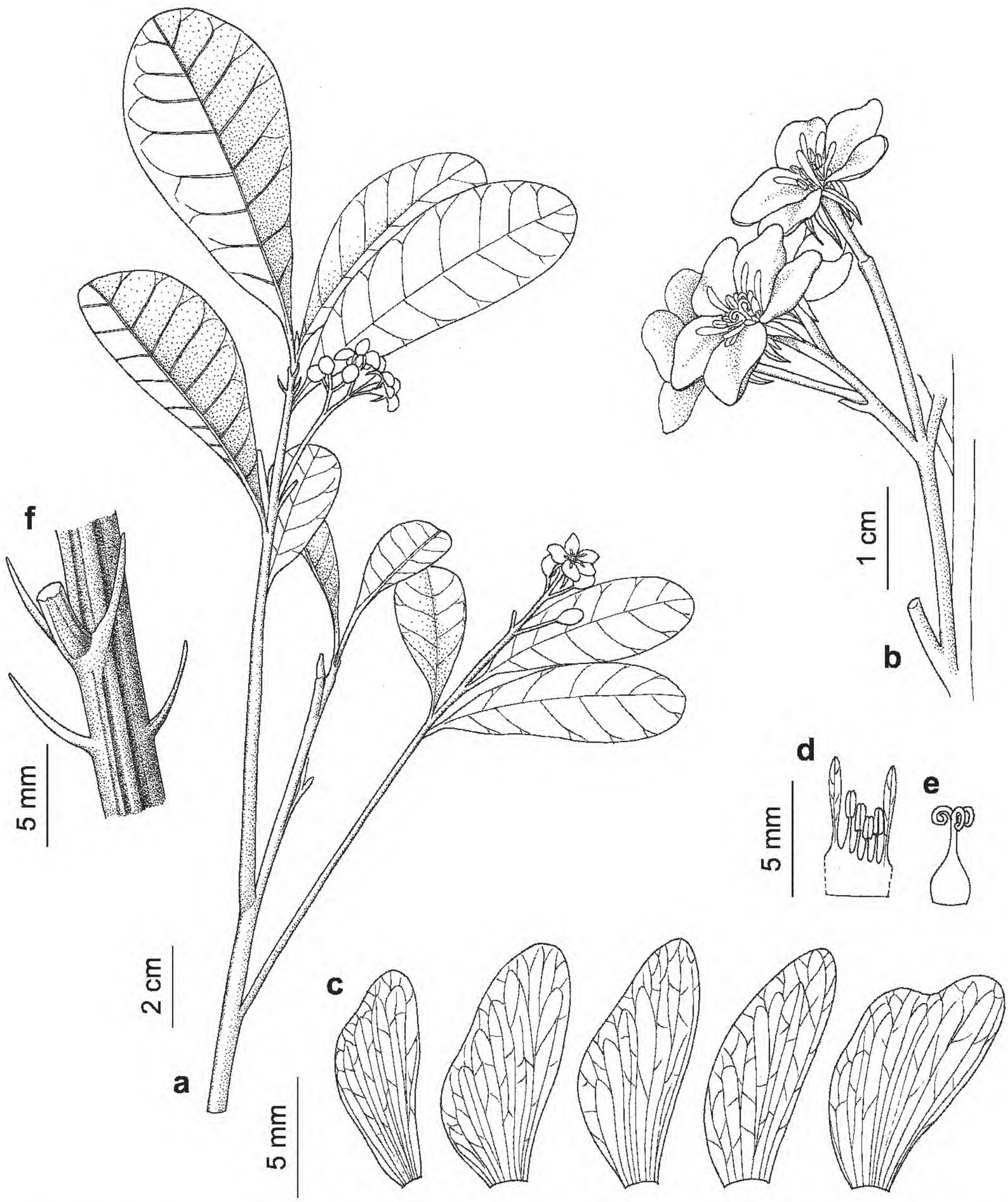

Figure 2. *Dombeya rienanensis* Applequist. —A. Flowering branch. —B. Flower. —C. Petals of a single flower. —D. Portion of androecium. —E. Gynoecium. —F. Stipules. A–F drawn from the type, *Humbert 3524* (P).

6); filaments 0.8–1.4 mm; anthers oblong, 0.9–1 mm; staminodes narrowly spatulate, 3.6–4.5 mm, exceeding stamens; gynoecium 3- to 4-carpellate; ovary lepidote, inner surfaces of locules glabrous; style lepidote only at base, ca. 1.2–1.8 mm; style lobes recurved, 1.5–2.5 mm; ovules not winged. Fruit unknown.

Habitat and distribution. The type collection was from humid forest in southeastern Madagascar, in the upper valley of the Rienana at a relatively high altitude (over 1000 m).

Phenology. Flowers have been collected in November.

Discussion. This species' sometimes 3-carpellate, not 5-carpellate gynoecium and characteristic small flowers place it in *Dombeya* subgen. *Xeropetalum*. The 4-carpellate condition seen in some flowers of the holotype is unusual but does occur, at least as an

abnormal condition, within other species of that subgenus. According to Arènes' (1958, 1959) classification, it would be placed within section *Xeropetalum*, subsection *Floribundae*, series *Epilosae*, subseries *Trohy* Arènes (sepals reflexed).

Many of Arènes' (1958, 1959) infrageneric groups are probably not monophyletic, as key characters occur repeatedly in his definitions of various infrageneric groups. For example, the presence or absence of reflexed sepals is the single character given to separate subseries *Trohy* from subseries *Repandae* within series *Epilosae* in *Dombeya*, and also the single character separating the monotypic subseries *Subsquamosae* Arènes from subseries *Dichotomae* Arènes within the hispid-ovaried series *Pilosae* Arènes (also within subsection *Floribundae*). Likewise, within section *Xeropetalum* alone there are two pairs of sister series differentiated by having scaly versus stellate-pubescent ovaries. It is to be hoped that a molecular systematic study now in progress (Skema, pers. comm.) will identify major monophyletic lineages. Despite the serious limitations of the existing classification, *D. rienanensis* does generally resemble and seems to be reasonably placed with the three previously described species of subseries *Trohy*, which are likewise native to humid forests of eastern Madagascar.

Those three species (*Dombeya oblongipetala* Arènes, *D. gracilicyma* Arènes, and *D. trohy* Arènes) are not well known; they were described from only one specimen each, with few collections added since. However, *D. rienanensis* can be differentiated from all three. Firstly, *D. rienanensis* is distinguished from *D. oblongipetala* and *D. trohy* by its obovate to oblanceolate leaves with rounded apices; *D. oblongipetala* has obovate-oblong to oblong leaves with obtuse apices, while *D. trohy* has oblong to elliptical leaves, to 14 cm long with petioles to 3 cm long. *Dombeya rienanensis* also has significantly smaller flowers than either of these species (petals 6.2–8 mm long vs. ca. 12–13 mm long) and more stamens (borne in groups of four or more, giving a minimum number of 20 vs. 15 or sometimes 10 in *D. oblongipetala*). *Dombeya rienanensis* most closely resembles *D. gracilicyma*, as both may have obovate leaves of similar size, but has much smaller inflorescences, larger and differently shaped stipules if such are present, greater stamen number (20 or more vs. 15), and smaller floral parts (pedicels less than 12 mm vs. 15–20 mm long; style less than 2 mm vs. 3–4 mm long; and androecial corona coroniform rather than tubuliform). Its petals may also be smaller (less than 8 mm, vs. a reported petal length of 9–11 mm in *D. gracilicyma*), but this character is often rather variable within species of *Dombeya*.

Dombeya rienanensis can also be easily confused with the widespread, variable eastern species *D. laurifolia*, mentioned above. Arènes (1959) listed the type specimen of *D. rienanensis* among examined material of *D. laurifolia*, which was placed within subseries *Repandae*. The leaves of *D. laurifolia* are sometimes similar to those of *D. rienanensis*, but—in addition to the non-reflexed sepals—*D. laurifolia* has only five or five to 10(to 15) stamens, a very short (0.5–1 mm) style, and short (3–4 mm) calyx lobes.

Notably, the type of *Dombeya rienanensis* has small patches of short, possibly glandular trichomes on the adaxial sepal surfaces at the extreme base, inside the very short fused portion of the calyx. A similar character is present in all species of the related genus *Helmiopsis* H. Perrier (Applequist, 2009), to which the type specimen has also once been referred. However, small glandular patches are also present in several species of *Dombeya* subg. *Dombeya* (pers. obs.) and may be present, although overlooked, in some other species of *Dombeya* not yet examined. *Helmiopsis*, whose members usually have a lepidote indument throughout, is differentiated from *Dombeya* by its usually winged seeds, often oppositisepalous stamens, and sometimes glandular petals; the stipules of *Helmiopsis* are small and immediately caducous. All but one, apparently derived species of *Helmiopsis* are 5-carpellate. *Dombeya rienanensis*, which has unwinged ovules, oppositipetalous stamens, and relatively large, occasionally persistent stipules, is clearly properly placed within *Dombeya*, as traditionally circumscribed, rather than *Helmiopsis*.

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A New Combination in *Toxicoscordion* (Melanthiaceae) for the Rocky Mountain Region, North America

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ABSTRACT. The new combination *Toxicoscordion venenosum* (S. Watson) Rydberg var. *gramineum* (Rydberg) Brasher (Melanthiaceae) is made to accommodate this taxon in this genus at the rank of variety for the Southern Rocky Mountain Interactive Flora (SRMIF) project. Recent chromosome and DNA sequence data support segregation of *Toxicoscordion* Rydberg from *Zigadenus* Michaux s.l.

Key words: Melanthiaceae, Southern Rocky Mountain Interactive Flora (SRMIF), *Toxicoscordion*, *Zigadenus*.

The need for a new combination in *Toxicoscordion* Rydberg (Melanthiaceae) was discovered in the process of constructing the Southern Rocky Mountain Interactive Flora (SRMIF) (<http://asstudents.unco.edu/students/lucid/>) (Brasher & Snow, 2003, onward) and revising the accompanying "Provisional Checklist of Vascular Plants for the Southern Rocky Mountain Interactive Flora," an earlier version of the Checklist of Vascular Plants of the Southern Rocky Mountain Region (Snow, 2009).

1. **Toxicoscordion venenosum** (S. Watson) Rydberg, Bull. Torrey Bot. Club 30: 272. 1903. Basionym: *Zigadenus venenosus* S. Watson, Proc. Amer. Acad. Arts 14: 279. 1879, as *Zygadenus venenosus*. TYPE: U.S.A. Utah: Summit Co., Parley's Peak, 6000 ft., June 1869, *S. Watson 1163* (lectotype, designated by Reveal, 1977: 488, GH not seen).

1a. **Toxicoscordion venenosum** (S. Watson) Rydberg var. **venenosum**.

1b. **Toxicoscordion venenosum** (S. Watson) Rydberg var. **gramineum** (Rydberg) Brasher, comb. nov. Basionym: *Zigadenus gramineus* Rydberg, Bull. Torrey Bot. Club 27: 535. 1900, as *Zygadenus gramineus*. *Toxicoscordion gramineum* (Rydberg) Rydberg, Bull. Torrey Bot. Club 30: 272. 1903. *Zigadenus venenosus* S. Watson var. *gramineus* (Rydberg) O. S. Walsh ex M. Peck, Man. Pl. Oregon 1941, nom. inval. *Zigadenus venenosus* S. Watson var. *gramineus* (Rydberg) O. S. Walsh ex C. L. Hitchcock, Vasc. Pl. Pacific NW 1: 815. 1969. TYPE: U.S.A. Montana: Galletin Co., Spanish Basin, 6500 ft., 28 June 1897, *P. A. Rydberg & E. A. Bessey 3848* (holotype, NY online image seen).

Zigadenus intermedius Rydberg, Bull. Torrey Bot. Club 27: 535. 1900. *Toxicoscordion intermedium* (Rydberg) Rydberg, Bull. Torrey Bot. Club 30: 272. 1903. TYPE: U.S.A. Idaho: Nez Perce Co., May 1892, *J. H. Sandberg 10564* (holotype, NY online image seen).

Zigadenus acutus Rydberg, Bull. Torrey Bot. Club 27: 536. 1900. *Toxicoscordion acutum* (Rydberg) Rydberg, Bull. Torrey Bot. Club 30: 272. 1903. TYPE: U.S.A. South Dakota: Black Hills, Box Elder Creek, June 1887, *W. S. Rusby s.n.* (holotype, NY online image seen).

Zigadenus falcatus Rydberg, Bull. Torrey Bot. Club 27: 536. 1900. *Toxicoscordion falcatum* (Rydberg) Rydberg, Bull. Torrey Bot. Club 30: 272. 1903. TYPE: U.S.A. Colorado: Larimer Co., Fort Collins, 5000 ft., 23 May 1893, *C. S. Crandall s.n.* (holotype, NY online image seen).

Distribution and habitat. Geographic distributions of the two varieties are as follows (USDA, 2009). Both occur in the American states of Utah, Idaho, Oregon, and Washington, and the Canadian provinces of Alberta and British Columbia in North America. Variety *gramineum* additionally extends eastward into the American states of New Mexico, Colorado, Nebraska, Wyoming, Montana, South Dakota, North Dakota, and the Canadian province of Saskatchewan. Variety *venenosum* additionally extends westward into the American states of Nevada and California.

Habitats of the two varieties differ. Variety *gramineum* inhabits inland grasslands and open pine woods from 500 to 1300 m (Schwartz, 2002), whereas variety *venenosum* occurs in coastal areas and well-drained grasslands from 0 to 2500 m.

Discussion. *Toxicoscordion* has been used in Colorado by Weber and Wittmann (1992, 2001) as one segregate genus removed from the broadly circumscribed genus *Zigadenus* Michaux s.l. The splitting of *Zigadenus* s.l. has been supported by chromosome number and DNA sequence data (Zomlefer et al., 2001; Zomlefer & Judd, 2002; Zomlefer, 2003).

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It seems best to recognize variety *gramineum* at varietal rank in *Toxicoscordion venenosum* rather than species rank following Reveal (1977), Dorn (2001), and Schwartz (2002). This recognizes the similarity of variety *gramineum* to typical *T. venenosum* over its similarity to other species in the genus. A key to varieties adapted from Schwartz (2002) and Reveal (1977) is given below.

1a. Upper stem leaves not sheathing; inflorescences mostly racemose, occasionally paniculate with 1 basal branch; outer tepals with claw 0.5–1 mm long . . . . . *Toxicoscordion venenosum* var. *venenosum*

1b. Upper stem leaves, except for the bracts of the inflorescence, all sheathing; inflorescences mostly paniculate with 1 or 2 basal branches, occasionally racemose; outer tepals not clawed or with a claw < 0.5 mm long . . . . . *Toxicoscordion venenosum* var. *gramineum*

According to the *International Code of Botanical Nomenclature* (Greuter et al., 2000), articles 32.1, 33.2, and 41.5, the combination *Zigadenus venenosus* S. Watson var. *gramineus* (Rydberg) O. S. Walsh ex M. Peck (1941) was not validly published, lacking reference to the publication of the basionym, but was later validated in Hitchcock (1969).

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Un Nuevo Estatus para *Sorocea sprucei* subsp. *subumbellata* (Moraceae)

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RESUMEN. Considerando las distintivas características morfológicas de las infrutescencias subumbeladas y las recientemente descubiertas inflorescencias y flores estaminadas de *Sorocea sprucei* (Baillon) J. F. Macbride subsp. *subumbellata* C. C. Berg, se propone elevar su rango a nivel de especie.

ABSTRACT. A species-level status for *Sorocea sprucei* (Baillon) J. F. Macbride subsp. *subumbellata* C. C. Berg is proposed here, recognizing the subumbellate infructescences and the sharply distinctive, previously unknown, and recently discovered staminate inflorescences and flowers.

Key words: Ecuador, Moraceae, Peru, *Sorocea*, subgen. *Paraclarisia*.

Sorocea sprucei (Baillon) J. F. Macbride es un arbusto o árbol dioico, perteneciente al subgen. *Paraclarisia* (Ducke) W. C. Burger, Lanjouw & Wessels Boer. Este se caracteriza por ser deciduo, con conspicuas yemas axilares globosas, hojas con láminas escabrosas; inflorescencias subcapitadas o en espigas cortas, brácteas submembranosas y estambres con muy cortos filamentos (Berg, 2001). *Sorocea sprucei* comprende tres subespecies: la típica subsp. *sprucei* y las subespecies *saxicola* (Hassler) C. C. Berg y *subumbellata* C. C. Berg (Berg, 2001). Las dos primeras subespecies presentan infrutescencias en espigas cortas o racemosas e inflorescencias estaminadas en espigas cortas a subcapitadas (subsp. *sprucei*) o capitadas (subsp. *saxicola*), con flores sésiles o subsésiles, cuyos pedicelos, cuando presentes, sólo alcanzan hasta 1 mm de longitud. En la subsp. *subumbellata* las infrutescencias son subumbeladas, con pedicelos más largos, de hasta 3.5 cm de longitud (Fig. 1), y sus inflorescencias estaminadas eran desconocidas (Berg & Rosselli, 1996; Berg, 1998, 2001). Esta es la única representante de *Sorocea* A. St.-Hilaire que se encuentra restringida al bosque seco del occidente de Ecuador (obs. pers.) y noroccidente de Perú, en el Dept. Tumbes (Berg & Rosselli, 1996; Berg, 1998, 2001). En el tratamiento taxonómico de la familia Moraceae de *Flora de Ecuador* (Berg, 1998: 44–45), la descripción de las inflorescencias estaminadas de la subsp. *subumbellata* está estrictamente basada en la subespecie típica, con la indicación de que solamente las flores pistiladas habían sido colectadas, sus flores estaminadas eran desconocidas. El 26 enero 2002, en el Bosque Protector Cerro Blanco, en la provincia del Guayas, Ecuador, el autor encontró individuos estaminados florecidos pertenecientes a la subsp. *subumbellata* y preservó algunas inflorescencias, éstas presentan diferentes características morfológicas de *S. sprucei* (Fig. 2A, B), por lo que se propone elevar su estatus al rango de especie.

Sorocea subumbellata (C. C. Berg) Cornejo, stat. nov. Basiónimo: *Sorocea sprucei* (Baillon) J. F. Macbride subsp. *subumbellata* C. C. Berg, Novon 6: 245. 1996. TIPO: Ecuador. Guayas: Road Guayaquil–Nobol, Km 24, secondary deciduous scrub, 21 Jan. 1985 (fl. ♀, fr.), *G. Harling & L. Andersson 21069* (holotipo, GB [foto digital]; isotipos, BG not seen, QCA).

Las inflorescencias estaminadas de *Sorocea subumbellata* difieren de las dos subespecies restantes de *S. sprucei* por ser: (1) racemosas, con flores claramente pediceladas (distintivo en *Sorocea*), cuyos pedicelos tienen mayor longitud (1.5–2 mm), (2) los tépalos en la antesis son ampliamente divergentes hasta ± reflexos, exponiendo las 4 anteras exsertas, y (3) sus filamentos hacia la base se encuentran fusionados formando una corta columna estaminal (monadelfia) (Fig. 2B). En *S. sprucei* subsp. *sprucei* y subsp. *saxicola*, los tépalos en la antesis son erectos, las anteras son sésiles o subsésiles con muy cortos filamentos (cuando presentes) libres, independientes y claramente separados entre sí, de modo que cada uno está unido directamente sobre un receptáculo ± plano (Fig. 2A).

Con excepción de la distantemente relacionada *Sorocea bonplandii* (Baillon) W. C. Burger, Lanjouw & Wessels Boer (del subgen. *Sorocea* A. St.-Hilaire), 12 de las 14 especies de *Sorocea* (es desconocido en *S. jaramilloi* C. C. Berg) presentan tépalos erectos en la antesis (Berg, 2001). La particular disposición de los tépalos (ampliamente divergentes hasta ± reflexos) que presenta *S. subumbellata* en la antesis y la particular estructura de los estambres con filamentos

Figura 1. Rama terminal con infrutescencias y frutos maduros de *Sorocea subumbellata* (*X. Cornejo 1806*).

fusionados formando una corta columna estaminal, a más de una clara diferencia morfológica en comparación con las subespecies *sprucei* (Fig. 2A) y *saxicola*, también sugieren una distinta biología floral. Además, es necesario notar que las anteras apiculadas, el segundo caracter de *S. sprucei* (Berg, 2001: 94, 132 [fig. 30: 9, 11]), es ausente en *S. subumbellata*, la que tiene anteras de ápices redondeados. Finalmente, a diferencia de *S. sprucei* subsp. *sprucei* y subsp. *saxicola* que tienen infrutescencias en espigas cortas o racemosas, las infrutescencias de *S. subumbellata* son subumbeladas. Estas diferencias mofológicas, en relación con el patrón fitogeográfico de *S. subumbellata*, restringida a los bosque secos costeros de Ecuador y Perú (Fig. 2B), ameritan para su reconocimiento formal a nivel de especie.

Fenología. Los individuos estaminados de *Sorocea subumbellata* tienen una floración explosiva aproximadamente a partir de la tercera semana después del inicio de la estación lluviosa, durante el mes de enero. Esta va acompañada con la producción de hojas nuevas y dura unas dos semanas, el resto del año los individuos estaminados permanecen estériles. Esta rápida floración explosiva anual es una de las razones porqué las inflorescencias estaminadas de esta especie no habían sido colectadas y eran desconocidas, pero al parecer también se debería a que posiblemente las poblaciones estaminadas estarían constituídos por pocos individuos.

Especímenes seleccionados. ECUADOR. **El Oro:** ca. 60 km SE of Arenillas, on rd. to Loja, *T. D. Pennington & G. Tenorio 10720* (QCA, QCNE, U); Cantón Arenillas, rd. Arenillas–Piedras, *T. Plowman 5471* (GH, S, U); Santa Rosa, *E. Asplund 15775* (S). **Guayas:** rd. Guayaquil–Salinas, Km 24, *C. H. Dodson, A. Gentry & F. M. Valverde 9601* (F, MO, U); Cerro Blanco, *X. Cornejo 1806* (BG, GUAY), *7872* (BG, GUAY), *D. Neill & T. Núñez 10473* (MO, NY, QCNE); Cerro Azul, W of Guayaquil, *E. Asplund 15630, 15631, 15389* (S); rd. Guayaquil–Daule, Km 21, *C. H. Dodson & P. M. Dodson 11454* (MO), *C. H. Dodson & A. Gentry 12346* (F). **Loja:** Bosque Petrificado Puyango, Quebrada El Chirimoyo, *X. Cornejo & C. Bonifaz 5021* (BG, GUAY); Puente Chico, 12 km N of Alamor, *A. Samaniego et al. 50* (LOJA, QAME, US). PERÚ. **Tumbes:** Tumbes, Pampas del Hospital, El Caucho, *C. Díaz, T. Pennington & C. Reynel 3224* (BG, MO).

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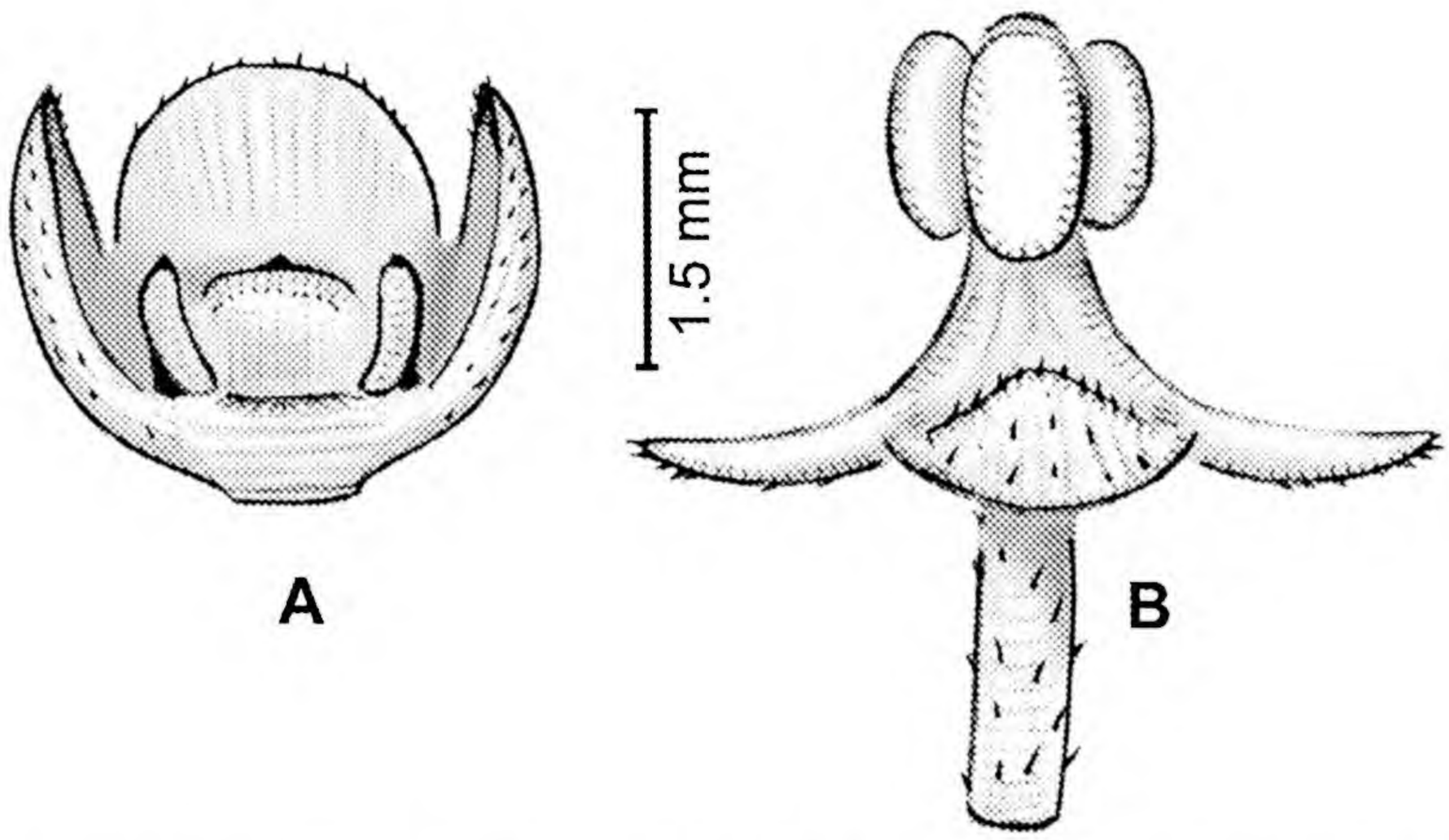

Figura 2. Flores estaminadas, en antesis. —A. *Sorocea sprucei* subsp. *sprucei* (tépalo y estambre anterior removidos). Nótese la ausencia de pedicelo (si presente, hasta 1 mm), posición erecta de los tépalos, estambres subsésiles y libres entre sí, insertos directamente sobre un receptáculo plano (*H. H. Smith 2411*, WIS). —B. *Sorocea subumbellata*. Nótese la longitud de los pedicelos (1.5–2 mm), los tépalos ampliamente divergentes hasta ± reflexos, exponiendo las cuatro anteras, de ápices sin apículo, cuyos filamentos se encuentran fusionados hacia la base formando una corta columna estaminal (*X. Cornejo 7872*).

realizar las observaciones de campo; a los curadores y herbarios visitados: GUAY, LOJA, MO, QCA, QCNE, WIS; a Claes Persson (GB) y Janeth Santiana (QCA), quienes gentilmente proporcionaron al autor fotografías digitales del holotipo e isotipo de *Sorocea sprucei* subsp. *subumbellata*; y a Kandis Elliot, artista del Departamento de Botánica de la Universidad de Wisconsin, por mejorar la ilustración de la Figura 2. Sergio Romaniuc Neto (SP) y un revisor anónimo realizaron críticas constructivas del manuscrito.

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Nomenclatural Actions for the New World Cypresses (Cupressaceae)

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Abstract. A new genus, *Neocupressus* de Laubenfels, is erected for the New World cypresses (Cupressaceae) to separate them from *Callitropsis* Oersted, where they have recently been placed. This is based on several sharp morphological distinctions. A new hybrid nothogenus, ×*Neocupropsis* de Laubenfels, is also erected to accommodate hybrid species from various species of *Neocupressus* and *Callitropsis*. The new combinations are: *Neocupressus arizonica* (Greene) de Laubenfels, *N. arizonica* var. *glabra* (Sudworth) de Laubenfels, *N. arizonica* var. *nevadensis* (Abrams) de Laubenfels, *N. arizonica* var. *montana* (Wiggins) de Laubenfels, *N. bakeri* (Jepson) de Laubenfels, *N. goveniana* (Gordon) de Laubenfels, *N. goveniana* var. *abramsiana* (C. B. Wolf) de Laubenfels, *N. goveniana* var. *pygmaea* (Lemmon) de Laubenfels, *N. guadalupensis* (S. Watson) de Laubenfels, *N. guadalupensis* var. *forbesii* (Jepson) de Laubenfels, *N. lusitanica* (Miller) de Laubenfels, *N. lusitanica* var. *lindleyi* (Klotzsch in Endlicher) de Laubenfels, *N. macnabiana* (A. Murray bis) de Laubenfels, *N. macrocarpa* (Hartweg) de Laubenfels, *N. sargentii* (Jepson) de Laubenfels, ×*Neocupropsis leylandii* (A. B. Jackson & Dallimore) de Laubenfels, ×*N. notabilis* (A. F. Mitchell) de Laubenfels, and ×*N. ovensii* (A. F. Mitchell) de Laubenfels. A lectotype is selected for *N. lusitanica* var. *lindleyi*.

Key words: *Callitropsis*, Cupressaceae, *Cupressus*, *Neocupressus*, New World cypresses, ×*Neocupropsis*.

In order to separate the Old World cypresses from the New World cypresses, Little (2006) placed the New World cypresses into the genus *Callitropsis* Oersted, a conclusion that sidesteps several clear-cut morphological differences. It has long been obvious to me and also to various other botanists (Little et al., 2004; Xiang & Li, 2005) that the New World cypresses differ markedly from the Old World cypresses. In my opinion, this is based on two distinct morphological characters: (1) all of the New World cypresses have multiple cotyledons (three or more; I collected some seedlings with two cotyledons in the southern range of *Neocupressus pygmaea* (Lemmon) de Laubenfels [de Laubenfels, 1963]). All of the Old World cypresses have two cotyledons, but with a distinct further character: the cotyledons are followed at the same level after germination by two smaller leaves and then by alternating whorls of four leaves, later reduced to whorls of three and then eventually to opposite decussate placement (a character shared by most of the remaining Cupressaceae s. str., de Laubenfels, 1953). Misidentification of *Cupressus lusitanica* Miller, which is widely cultivated and possibly escaped in the Old World, has led to reports of additional cotyledons there. For example, seed from a cultivated plant, said to be *C. assamica* Silba (*C. himalaica* Silba) (Silba, 1994), was grown at Hillier Gardens in England, where it later turned out to be *C. lusitanica* (de Laubenfels, pers. obs.). The New World cypress cotyledons are followed directly by alternating whorls of three or four leaves. Relatives of species with the special dicot habit can lose it, as in several species of *Juniperus* L. and in *Tetraclinis* Masters, but the presence of this unusual cotyledonary trait marks a clear-cut distinction. The occurrence of a few examples of this trait in *N. pygmaea* suggests that it is also a lost trait in the New World cypresses. (2) All of the New World cypresses, except *C. benthamii* Endlicher (see treatment below), have monomorphic leaves. Only rarely are the branchlets distichous (*C. macnabiana* A. Murray bis). All but one of the Old World cypresses (*C. duclouxiana* B. Hickel in Camus) have distichous branchlets whose leaves, furthermore, are dimorphic with lateral leaves keeled so that the branchlets become flattened. The dimorphic character is most obvious on juvenile branchlets and can be more or less obscure or even lost with age. A majority of Cupressaceae genera have the dimorphic habit and, as in Old World cypresses, some related species may have lost it, but the dimorphic leaf trait, where it occurs, is a clear-cut distinction. The distichous habit of branchlets is not lost with age.

Little (2006) based the distinction between the Old World and New World cypresses on a suite of characters, no one alone being diagnostic. He presented a series of cladograms to demonstrate the relationship. In fact, the cotyledonary condition is, indeed, diagnostic. This, then, is further supported by Little's careful statistical analysis. Unfortunately, for identification purposes, the cotyledonary character is not usually available. The distichous habit, for its part, distinguishes all but *Cupressus duclouxiana*

among the Old World species. Because this species, as seen in Little's analysis (Little, 2006), falls well within the suite of Old World cypress characters, it would appear that it has lost the distichous habit rather than being a transitional species. There is no argument here with the generic separation of the Old World cypresses from the New World cypresses, but rather with the strategy of how to bring it about.

In Little's (2006) analysis, he identified two monophyletic groups of species, one being the genus *Juniperus* and the other forming the genus *Callitropsis*, intermediate between the Old World and the New World cypresses. The genus *Juniperus* can be readily distinguished by non-dehiscing cones and other characters. In his analysis, Little found the genus *Callitropsis* to be closer to the New World cypresses than to the Old World cypresses. This led him to consider several strategies, among which he included the placing of the New World cypresses into *Callitropsis* or, conversely, erecting a new genus for the New World cypresses, and he chose the former strategy. This is unfortunate, because no matter how closely the two may be related, they are strikingly different in obvious ways. Not only do the species of *Callitropsis* have markedly distichous ultimate branch systems, but the lateral leaves are sharply bent and distinctly larger like other Cupressaceae genera including *Fokienia* A. Henry & H. H. Thomas, *Thujopsis* Siebold & Zuccarini, *Calocedrus* Kurz, and *Libocedrus* Endlicher, particularly at the juvenile stage. Furthermore, both species, on juvenile shoots, show a clear differentiation between the upper and the lower sides of the branchlets. Another distinction is the small cones of *Callitropsis* normally with only four fertile scales, where all cypresses normally have six or more. The dimorphic leaf sizes, sometimes different for leaves on the upper branchlet surface versus those on the lower branchlet surface, as well as the smaller cones make *Callitropsis* differ from the New World cypresses in ways that the Old World cypresses do not. The two previously described species of *Callitropsis* further have the cotyledonary condition of the Old World cypresses and rather few seeds per fertile scale.

The position of *Cupressus benthamii* requires special consideration at this point. It is often considered a variety of *C. lusitanica* simply because they both grow in Mexico. These two taxa are sharply different. *Cupressus benthamii* has well-marked distichous branchlets with distinctly dimorphic leaves such that the ultimate branch systems are strongly flattened. The seed cones normally have only four fertile scales. These characters not only distinguish it from *C. lusitanica*, but also from all other New World cypresses while allying it with *Callitropsis*. One of Little's cladograms (Little, 2006: 469, fig. 4) actually groups it (along with *Cupressus funebris* Endlicher) with *Callitropsis*. Because of these obvious distinctions and because, in my experience, most specimens in herbaria and arboreta identified as *C. benthamii* have been misidentified, I consider that error may have contaminated the data used by Little (although, to be sure, Little's personal collections at BH are correctly identified). For that reason, I am not prepared to separate it from *Callitropsis* as I would all the remaining species of New World cypresses. Unlike the other *Callitropsis* species, but like *C. lusitanica*, *C. benthamii* has three or four cotyledons and has numerous seeds per fertile scale. These conditions could be the result of introgression from *C. lusitanica*. It is worth noting that *Callitropsis* (*Cupressus*) *benthamii* is morphologically very close to ×*Neocupropsis leylandii* (A. B. Jackson & Dallimore) de Laubenfels, a hybrid between *Callitropsis* and *Neocupressus*, the main distinction being that the latter normally has six seed cone scales.

In order to separate the New World cypresses from *Callitropsis* (including *Cupressus benthamii*), it is necessary to erect a new genus, for which the name *Neocupressus* is here proposed. Eight species and seven varieties are involved. There are nine species of Old World cypress and, with *C. benthamii*, three species of *Callitropsis*. This treatment would require a small revision of the genus *Callitropsis*.

I. Neocupressus de Laubenfels, gen. nov. TYPE: *Neocupressus macrocarpa* (Hartweg) de Laubenfels.

Hoc genus a *Callitropside* Oersted foliis non dimorphis et strobili feminei squamis fertilis plerumque 6 ad 12 (raro 4) differt.

Trees or shrubs with multiple cotyledons (3 or more, most commonly 4 [Wolf, 1948]; in a few species 3 may be most common); branchlets not distichous or rarely distichous. Leaves in alternate whorls, each whorl at first in seedlings usually of 4 linear leaves, gradually reduced to whorls of 3, and finally opposite decussate leaves scale-like when adult and similar (never differentiated into lateral and facial forms). Seed cones with 6 to 12 peltate woody fertile scales (sporadically 4), 8 to 15 erect seeds per fertile scale (sometimes less on lowest or uppermost scales).

Infrataxa as varieties are applied here, as historically they have been most used in *Cupressus* L. Synonyms are given only where not found in Wolf (1948) or Farjon (2005) or where they are different from these.

1. Neocupressus arizonica (Greene) de Laubenfels, comb. nov. Basionym: *Cupressus arizonica*

Greene, Bull. Torrey Bot. Club 9: 64. 1882. *Cupressus benthamii* Endlicher var. *arizonica* (Greene) Masters, J. Linn. Soc. Bot. 31: 340. 1896. *Callitropsis arizonica* (Greene) D. P. Little, Syst. Bot. 31: 473. 2006. TYPE: U.S.A. Arizona: Clifton (on the mountains back of Clifton), 1 Nov. 1880, *E. L. Greene s.n.* (lectotype, designated by Little, 2006: 473, NDG not seen; isotypes, K, NA not seen, NY).

The type variety of *Neocupressus arizonica* is substantially variable, especially as to the degree of leaf gland activity, peeling of the bark, and number of serotinous seed cones, such that examples closer to its varieties or other species could be selected within normal populations.

1a. Neocupressus arizonica (Greene) de Laubenfels var. **arizonica**.

1b. Neocupressus arizonica (Greene) de Laubenfels var. **glabra** (Sudworth) de Laubenfels, comb. nov. Basionym: *Cupressus glabra* Sudworth, Amer. Forest. 16: 88. 1910. *Cupressus arizonica* Greene var. *glabra* (Sudworth) Little, Madroño 18: 162. 1966. *Cupressus arizonica* Greene subsp. *glabra* (Sudworth) A. E. Murray, Kalmia 12: 19. 1982. *Callitropsis glabra* (Sudworth) D. P. Little, Syst. Bot. 31: 473. 2006. TYPE: U.S.A. Arizona: Yavapai Co., N slope of Verde River Canyon, 29 Dec. 1909, *G. B. Sudworth s.n.* (holotype, US; isotypes, A, ARIZ not seen, RSA, USFS not seen).

Cupressus stephensonii C. B. Wolf, Aliso 1: 125. 1948, syn. nov. *Cupressus arizonica* Greene var. *stephensonii* (C. B. Wolf) E. L. Little, Madroño 18: 164. 1966. *Cupressus arizonica* Greene subsp. *stephensonii* (C. B. Wolf) E. Murray, Kalmia 12: 19. 1982. *Callitropsis stephensonii* (C. B. Wolf) D. P. Little, Syst. Bot. 31: 474. 2006. TYPE: U.S.A. California: San Diego Co., Cuyamaca Mtns., upper limit of King Creek, 1 Dec. 1938, *C. B. Wolf 9467* (holotype, RSA; isotypes, BH, CAS not seen, K, MEXU not seen, MO not seen, NA not seen, NY).

Cupressus arizonica Greene var. *revealiana* J. Silba, Phytologia 49: 393. 1981, syn. nov. *Cupressus arizonica* Greene subsp. *revealiana* (Silba) Silba, J. Int. Conif. Preserv. Soc. 12: 51. 2005. TYPE: Mexico. Baja California N: Sierra Juarez, 2 km NE of El Rincon, 21 Apr. 1974, *R. Moran 21251* (holotype, SD not seen; isotype, MO not seen).

Neocupressus arizonica var. *glabra* has bark peeling in plates rather than the fibrous bark in strips of the type variety and is generally much more glaucous with more active leaf glands.

Cupressus stephensonii is known from one small population near San Diego, California. The large seed lies within the size range of seed of variety *glabra*.

Farjon (2005) placed *Cupressus arizonica* var. *revealiana* in synonymy with his variety *stephensonii* such that now it must be transferred to synonymy with variety *glabra*. The relatively small seed in this small population is within the size range of variety *glabra*.

1c. Neocupressus arizonica (Greene) de Laubenfels var. **nevadensis** (Abrams) de Laubenfels, comb. nov. Basionym: *Cupressus nevadensis* Abrams, Torreya 19: 92. 1919. *Cupressus macnabiana* A. Murray bis var. *nevadensis* (Abrams) Abrams, Ill. Fl. Pacific States 1: 73. 1923. *Cupressus arizonica* Greene var. *nevadensis* (Abrams) Little, Madroño 18: 164. 1966. *Cupressus arizonica* Greene subsp. *nevadensis* (Abrams) A. E. Murray, Kalmia 12: 19. 1982. *Callitropsis nevadensis* (Abrams) D. P. Little, Syst. Bot. 31: 474. 2006. TYPE: U.S.A. California: Kern Co., Piute Mtns., Red Hill near Bodfish, 29 July 1915, *L. Abrams 5368* (holotype, DS not seen; isotypes, NY, RSA, US).

The variety *nevadensis* has blunter umbos on the seed cone scales and much more active glands on the leaves than the type variety.

1d. Neocupressus arizonica (Greene) de Laubenfels var. **montana** (Wiggins) de Laubenfels, comb. nov. Basionym: *Cupressus montana* Wiggins, Contr. Dudley Herb. 1: 161. 1933. *Cupressus arizonica* Greene var. *montana* (Wiggins) Little, Madroño 18: 163. 1966. *Cupressus arizonica* Greene subsp. *montana* (Wiggins) A. E. Murray, Kalmia 15: 11. 1985. *Callitropsis montana* (Wiggins) D. P. Little, Syst. Bot. 31: 474. 2006. TYPE: Mexico. Baja California: Sierra San Pedro Mártir, La Encantada, 22 Sep. 1930, *I. L. Wiggins & D. Demaree 4990* (holotype, DS not seen; isotypes, F not seen, MEXU not seen, NA not seen, NY, RSA, SD not seen, US).

Variety *montana* differs from the type variety in the immediate opening of the seed cones upon maturity.

2. Neocupressus bakeri (Jepson) de Laubenfels, comb. nov. Basionym: *Cupressus bakeri* Jepson, Fl. Calif. 1: 61. 1909. *Cupressus macnabiana* A. Murray bis var. *bakeri* (Jepson) Jepson, Man. Fl. Pl. Calif. 58. 1923. *Callitropsis bakeri* (Jepson) D. P. Little, Syst. Bot. 31: 473. 2006. TYPE: U.S.A. California: Siskiyou Co., near Dana, Aug. 1898, *M. S. Baker s.n.* (holotype, JEPS not seen).

3. Neocupressus goveniana (Gordon) de Laubenfels, comb. nov. Basionym: *Cupressus goveniana* Gordon, J. Hort. Soc. London 4: 295. 1849. *Callitropsis goveniana* (Gordon) D. P. Little, Syst. Bot. 31: 473. 2006. TYPE: U.S.A. California: Monterey Co., 2 mi. from sea, 1849, *Hartweg s.n.* (cultivated from seed) (holotype, K).

3a. Neocupressus goveniana (Gordon) de Laubenfels var. **goveniana**.

Cupressus goveniana Gordon subsp. *gibsonensis* Silba, J. Int. Conifer Preserv. Soc. 10: 32. 2003, syn. nov. TYPE: U.S.A. California: Monterey Co., Gibson Creek, 26 Oct. 2003, *J. Silba B289* (holotype, NY).

Cupressus abramsiana C. B. Wolf subsp. *neolomondensis* Silba, J. Int. Conif. Preserv. Soc. 10: 33. 2003, syn. nov. TYPE: U.S.A. California: Santa Cruz Co., Majors Creek, near Ben Lomond Peak, Jan. 2003, *J. Silba B314* (holotype, NY).

Subspecies *gibsonensis* highlights the non-dwarfed form of the type variety found also in the type locality, with trees to 7 m and seed cones about 2 cm long with seed to 4 mm long.

Subspecies *neolomondensis* differs from variety *abramsiana* in the non-glaucousness of the seed such that the subspecies as described is identical to the variety *goveniana*. The subspecies *neolomondensis* population adds a third grove to variety *goveniana* on the north side of Monterey Bay. A fourth grove is found near Anchor Bay in Mendocino County near the variety *pygmaea*.

3b. Neocupressus goveniana (Gordon) de Laubenfels var. **abramsiana** (C. B. Wolf) de Laubenfels, comb. nov. Basionym: *Cupressus abramsiana* C. B. Wolf, Aliso 1: 215. 1948. *Cupressus goveniana* Gordon var. *abramsiana* (C. B. Wolf) Little, Phytologia 20: 435. 1970. *Cupressus goveniana* Gordon subsp. *abramsiana* (C. B. Wolf) A. E. Murray, Kalmia 12: 19. 1982. *Callitropsis abramsiana* (C. B. Wolf) D. P. Little, Syst. Bot. 31: 473. 2006. TYPE: U.S.A. California: Santa Cruz Co., Ben Lomond near Bonnie Doon, 9 Nov. 1934, *C. B. Wolf 6235* (holotype, RSA; isotypes, BH, CAS not seen, DS not seen, K, MEXU not seen, MO not seen, NA not seen, NY).

Variety *abramsiana* differs primarily in the glaucousness of the seeds, which may be due to introgression from nearby stands of *Neocupressus sargentii* (Jepson) de Laubenfels, which until now have been misidentified as *Cupressus abramsiana* (perhaps due to their geography!). Strictly speaking, this variety occurs only in the vicinity of Bonnie Doon in California.

3c. Neocupressus goveniana (Gordon) de Laubenfels var. **pygmaea** (Lemmon) de Laubenfels, comb. nov. Basionym: *Cupressus goveniana* Gordon var. *pygmaea* Lemmon, Cone-bear. Trees Pacif. Slope ed. 3: 77. 1895, as *pigmaea*. *Cupressus pygmaea* (Lemmon) Sargent, Bot. Gaz. 31: 239. 1901. *Cupressus goveniana* Gordon subsp. *pigmaea* (Lemmon) A. Camus, Encycl. Econ. Sylvicult. 2: 50. 1914. *Callitropsis pygmaea* (Lemmon) D. P. Little, Syst. Bot. 31: 474. 2006. TYPE: U.S.A. California: Mendocino Co., White Plains, back from the coast, [1880s], *J. G. Lemmon & wife s.n.* (lectotype, designated by Wolf, 1948: 200, UC not seen; isotype, DS not seen).

Variety *pygmaea* differs from the type variety in *Neocupressus goveniana* in having shiny black seeds that are not dull blackish to dark brown. The inclusion of the Anchor Bay grove in this variety by Wolff (1948) and many others (rather than the type variety of *N. goveniana*) has confused the status of variety *pygmaea*.

4. Neocupressus guadalupensis (S. Watson) de Laubenfels, comb. nov. Basionym: *Cupressus guadalupensis* S. Watson, Proc. Amer. Acad. Arts, n.s. 14: 300. 1879. *Cupressus macrocarpa* Hartweg var. *guadalupensis* (S. Watson) Masters, Gard. Chron., ser. 3, 18: 62. 1895. *Callitropsis guadalupensis* (S. Watson) D. P. Little, Syst. Bot. 31: 473. 2006. TYPE: Mexico. Guadalupe Island, 1875, *E. Palmer 92* (holotype, GH; isotypes, CHS not seen, K, NA not seen, NY, P not seen).

4a. Neocupressus guadalupensis (S. Watson) de Laubenfels var. **guadalupensis**.

4b. Neocupressus guadalupensis (S. Watson) de Laubenfels var. **forbesii** (Jepson) de Laubenfels, comb. nov. Basionym: *Cupressus forbesii* Jepson, Madroño 1: 75. 1922. *Cupressus guadalupensis* S. Watson var. *forbesii* (Jepson) Little, Phytologia 20: 435. 1970. *Cupressus guadalupensis* S. Watson subsp. *forbesii* (Jepson) R. M. Beauchamp, Aliso 9: 191. 1978. *Callitropsis forbesii* (Jepson) D. P. Little, Syst. Bot. 31: 473. 2006. TYPE: U.S.A. California: San Diego Co., betw. El Nido & Dulzura, 30 Dec. 1907, *C. N. Forbes s.n.* (holotype, JEPS not seen; isotypes, BH, CAS not seen, DS not seen, MEXU not seen, MO not seen, NA not seen, NY, RSH not seen, UC not seen, US).

Cupressus forbesii Jepson has been widely considered a variety of *C. guadalupensis*, differing in the

lack of glaucousness and a slightly shorter pollen cone.

5. Neocupressus lusitanica (Miller) de Laubenfels, comb. nov. Basionym: *Cupressus lusitanica* Miller, Gard. Dict., ed. 8, no. 3. 1768. *Callitropsis lusitanica* (Miller) D. P. Little, Syst. Bot. 31: 474. 2006. TYPE: Portugal. Cultivated in Herb. Miller, *anonymous s.n.* (holotype, BM).

The origin of *Neocupressus lusitanica* has long been a problem inasmuch as it was described from Old World material. Martinez (1942), in particular, rejected a Mexican origin. More recently, Silba (1994) has pressed that claim. However, most, if not all of the critical material from the Old World is from cultivation, and I have personally collected material exactly of the species in the forests on the slopes of Mt. Ixtacihuatl along the route of conquistadors where cypresses surely were first encountered in Mexico by Europeans (*de Laubenfels 687*, personal collection). Franco (1945) and Farjon (1993, 2005) have made the case for a New World origin, the position adopted here. My collection could be considered an epitype.

5a. Neocupressus lusitanica (Miller) de Laubenfels var. **lusitanica**.

Cupressus himalaica Silba var. *darjeelingensis* Silba, Phytologia 68: 29. 1990, syn. nov. *Cupressus darjeelingensis* (Silba) Silba, J. Int. Conifer Preserv. Soc. 1: 18. 1994. TYPE: India. W. Bengal: cult. near Kalimpong, s.d., *C. G. Trevor s.n.* (holotype, K).

Silba's (1990) description of *Cupressus himalaica* var. *darjeelingensis* material does not match his holotype, which is *Neocupressus lusitanica*, in that he reports flattened branchlets in long chain-like segments.

5b. Neocupressus lusitanica (Miller) de Laubenfels var. **lindleyi** (Klotzsch in Endlicher) de Laubenfels, comb. nov. Basionym: *Cupressus lindleyi* Klotzsch in Endlicher, Syn. Conif.: 59. 1847. *Cupressus lusitanica* Miller var. *lindleyi* (Klotzsch in Endlicher) Carrière, Traité Gén. Conif., ed. 2: 156. 1867. *Cupressus benthamii* Endlicher var. *lindleyi* (Klotzsch in Endlicher) Masters, J. Linn. Soc., Bot. 31: 339. 1896. TYPE: Mexico. Michoacán: betw. Angangueo & Tlalpuxahua, 1839, *C. T. Hartweg 437* (lectotype, designated here, K; isotypes, BM, MO not seen).

Cupressus lindleyi is better identified as a more robust variety of the species *Neocupressus lusitanica* that is common to drier and more exposed locations. Martinez (1942) took great pains to distinguish *C. lindleyi* from *C. lusitanica* because of his belief that the latter was not of Mexican origin. My own experience collecting in Mexico supports the conclusion that two varieties are involved. The holotype of *C. lindleyi* has been destroyed, but isotypes exist from which a lectotype was selected.

6. Neocupressus macnabiana (A. Murray bis) de Laubenfels, comb. nov. Basionym: *Cupressus macnabiana* A. Murray bis, Edinburgh New Philos. J., n.s. 1: 293. 1855. *Callitropsis macnabiana* (A. Murray bis) D. P. Little, Syst. Bot. 31: 474. 2006. TYPE: U.S.A. California: "circa lat. 41° Bor.," Sep.? 1854, *W. Murray s.n.* (holotype, E).

7. Neocupressus macrocarpa (Hartweg) de Laubenfels, comb. nov. Basionym: *Cupressus macrocarpa* Hartweg, J. Hort. Soc. London 2: 187. 1847. *Callitropsis macrocarpa* (Hartweg) D. P. Little, Syst. Bot. 31: 474. 2006. TYPE: U.S.A. California: Monterey Co., Carmel Bay, 1846, *K. T. Hartweg 143* (holotype, K).

Cupressus macrocarpa Hartweg subsp. *lobosensis* Silba, J. Int. Conifer Preserv. Soc. 10: 30. 2003, syn. nov. TYPE: U.S.A. California: Monterey Co., Point Lobos, 16 Oct. 2002, *J. Silba B249* (holotype, NY).

The subspecies *lobosensis*, from the southern grove population of the species in Monterey County, as described by Silba in 2003, lies within the range of characters of the type and tends to emphasize the tendency of older trees of *Cupressus macrocarpa* to have larger seed cones and thicker foliage, also found in its type locality on Carmel Bay.

8. Neocupressus sargentii (Jepson) de Laubenfels, comb. nov. Basionym: *Cupressus sargentii* Jepson, Fl. Calif. 1: 61. 1909. *Cupressus goveniana* Gordon var. *sargentii* (Jepson) A. Henry in Elwes & A. Henry, Trees Great Britain 1173. 1910. *Callitropsis sargentii* (Jepson) D. P. Little, Syst. Bot. 31: 474. 2006. TYPE: U.S.A. California: Mendocino Co., Mayacamas Range, Red Mtn., 18 June 1908, *W. L. Jepson 3027* (holotype, JEPS not seen).

Cupressus abramsiana C. B. Wolf subsp. *locatellii* Silba, J. Int. Conifer Preserv. Soc. 10. 32. 2003, syn. nov. TYPE: U.S.A. California: Santa Cruz Co., Eagle Rock, Dec. 2002, *J. Silba B301* (holotype, NY; isotype, RSA).

Differences of subspecies *locatellii* and the following synonymous taxa from *Neocupressus go-*

veniana var. *abramsiana* place them in *N. sargentii* with only minor morphological differences at best. They are found at roughly the midpoint of the distribution for *N. sargentii*, which extends from Mendocino County in the north to Santa Barbara County in the south. This subspecies has rather smaller seeds (only 2.5–3 mm long) than usual for *N. sargentii*, which has seeds at least 3.2 mm long.

Cupressus abramsiana C. B. Wolf subsp. *opleri* Silba, J. Int. Conifer Preserv. Soc. 10: 33. 2003, syn. nov. TYPE: U.S.A. California: Santa Cruz Co., near Forest Springs, Dec. 2002. *J. Silba, D. Taylor & A. Opler B311* (holotype, NY; isotype, RSA).

Subspecies *opleri* has light green (not dusty green as in variety *sargentii*) foliage and rather smaller seeds (2.5–3 mm long) than *N. sargentii*.

Cupressus abramsiana C. B. Wolf subsp. *butanoensis* Silba, J. Int. Conifer Preserv. Soc. 10: 34. 2003, syn. nov. TYPE: U.S.A. California: San Mateo Co., Butano Ridge, s.d., *C. McMillan 1620* (holotype, NY).

There are no distinctions between the description of subspecies *butanoensis* by Silba and *Neocupressus sargentii*. The fact that *butanoensis* (and the above two subspecies, *locatellii* and *opleri*) do not grow on serpentine like typical *N. sargentii* (Wolf, 1948) is not sufficient basis for separation.

Key to the Species of *Neocupressus*

1a. Active glands on at least some of the leaves (leaves never rich green).
  2a. Immature seed cone scale conical-acute, branchlets distichous . . . . . 6. *N. macnabiana*
  2b. Seed cone scales peltate with a central umbo, branchlets not distichous.
    3a. Seed cone scales covered with warts, branchlets to 1.3 mm diam. . . . . 2. *N. bakeri*
    3b. Seed cone scales not warty, branchlets to 1.7 mm diam . . . . . 1. *N. arizonica*
1b. Glands inactive to absent.
  4a. Seed cone serotinous, at least partially.
    5a. Bark fibrous in strips.
      6a. Usually 8 pollen sacs per scale, seed cone 24–33 mm diam. (seed not glaucous, foliage bright green). . . . . 7. *N. macrocarpa*
      6b. Never 8 pollen sacs per scale, seed cone 15–25 mm diam.
        7a. Pollen sacs 3 to 4 per scale, branchlets 1.5–2 mm diam. (seed glaucous, foliage dull green) . . . . . 8. *N. sargentii*
        7b. Pollen sacs 5 to 6 per scale, branchlets 1–1.5 mm diam. . . . . 3. *N. goveniana*
    5b. Bark exfoliating in plates (branchlets 1–1.4 mm diam., seed not glaucous) . . . . . 4. *N. guadalupensis*
  4b. Seed cone always opening on maturity (bark fibrous, 4 pollen sacs per scale, seed not glaucous) . . . 5. *N. lusitanica*

Several hybrids involving *Callitropsis nootkatensis* (D. Don) Oersted ex D. P. Little, and various species of New World cypresses have been reported by Jackson and Dallimore (1926) and Mitchell (1970) and have been placed in the hybrid genus ×*Cupressocyparis* Dallimore, formed from the genera *Chamaecyparis* Spach (considered the genus for *C. nootkatensis*) and *Cupressus*. Because the genera involved in the parent formula for the nothogenus have changed, the name of the hybrid genus ×*Cupressocyparis* must also be changed, for which the name ×*Neocupropsis* is proposed.

II. ×**Neocupropsis** de Laubenfels, nothogen. nov. TYPE: ×*Neocupropsis leylandii* (A. B. Jackson & Dallimore) de Laubenfels.

×*Cupressocyparis* Dallimore, Forestry 11: 3. 1937.
×*Cuprocyparis* Farjon, Novon 12: 188. 2002.

1. ×**Neocupropsis leylandii** (A. B. Jackson & Dallimore) de Laubenfels, comb. nov. Basionym: *Cupressus* ×*leylandii* A. B. Jackson & Dallimore, Bull. Misc. Inform. Kew 1926: 114. 1926. ×*Cupressocyparis leylandii* (A. B. Jackson & Dallimore) Dallimore, Forestry (Oxford) 11: 3. 1937. ×*Cuprocyparis leylandii* (A. B. Jackson & Dallimore) Farjon, Novon 12: 188. 2002. *Callitropsis* ×*leylandii* (A. B. Jackson & Dallimore) D. P. Little, Syst. Bot. 31: 474. 2006. TYPE: United Kingdom. Northumberland: Haggerston Castle, (cultivated), 26 Nov. 1925, *E. J. Leyland s.n.* (lectotype, designated by Farjon et al., 2002: 188, K not seen).

2. ×**Neocupropsis notabilis** (A. F. Mitchell) de Laubenfels, comb. nov. Basionym: ×*Cupressocyparis notabilis* A. F. Mitchell, J. Roy. Hort. Soc. 95(10): 453. 1970. ×*Cuprocyparis notabilis* (A. F. Mitchell) Farjon, Novon 12: 188. 2002. TYPE: United Kingdom. Hampshire: Forest Research Station, Alice Holt Lodge, (cultivated), 31 July 1963, *A. F. Mitchell s.n.* (holotype, K not seen).

3. ×**Neocupropsis ovensii** (A. F. Mitchell) de Laubenfels, comb. nov. Basionym: ×*Cupressocyparis ovensii* A. F. Mitchell, J. Roy. Hort. Soc. 95(10): 454. 1970. ×*Cuprocyparis ovensii*

(A. F. Mitchell) Farjon, Novon 12: 188. 2002. TYPE: United Kingdom. Hampshire: Forest Research Station, Alice Holt Lodge, (cultivated), 1970, *A. F. Mitchell s.n.* (holotype, K not seen).

All three ×*Neocupropsis* species are strictly horticultural in origin and, because they all involve *Callitropsis nootkatensis*, they are quite similar. ×*Neocupropsis leylandii* is a hybrid with *Neocupressus macrocarpa* and is very similar to *C. nootkatensis* including seed cones to 20 mm in diameter but without the drooping branches. ×*Neocupropsis notabilis* is a hybrid with *Neocupressus arizonica* var. *glabra* and has much more open branching with glaucous seed cones only 12 mm in diameter. ×*Neocupropsis ovensii* is a hybrid with *Neocupressus lusitanica* and has the open branching with the drooping habit and also small glaucous seed cones.

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A New Combination in *Mackaya* (Acanthaceae), with Lectotypification for *Mackaya tapingensis*

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Abstract. Comparative survey of morphological characters shows that *Eranthemum tapingense* W. W. Smith is better treated in *Mackaya* Harvey. Consequently, a new combination, *M. tapingensis* (W. W. Smith) Y. F. Deng & C. Y. Wu, is proposed, and its lectotype is designated. The species is distributed in China and Burma (Myanmar).

Key words: Acanthaceae, *Eranthemum*, *Mackaya*, *Pseuderanthemum*.

While revising the family Acanthaceae for the forthcoming volume 19 of *Flora of China*, the position of *Pseuderanthemum tapingense* (W. W. Smith) C. Y. Wu & H. S. Lo (Anonymous, 1975) was drawn to our attention because it differs from other members of *Pseuderanthemum* Radlkofer in its secund flowers in terminal racemes and its campanulate corolla without a long slender cylindrical tube. The species was originally described as *Eranthemum tapingense* W. W. Smith (Smith, 1918) from three collections from Burma (Myanmar), i.e., *Forrest 9655*, *9484*, and *12149*. In the original description, Smith (1918) indicated that this taxon was related to *E. indicum* (Nees) C. B. Clarke and *E. lateriflorum* C. B. Clarke. *Eranthemum indicum*, originally described in *Thyrsacanthus* Nees as *T. indicus* Nees, was transferred to *Mackaya* Harvey by Ensermu et al. (1992), and *E. lateriflorum* to *Gymnostachyum* Nees by Hansen (1985a). It is reasonable, then, to re-evaluate the position of *E. tapingense*.

Wu (1984) included *Eranthemum tapingense* in his *Index Florae Yunnanensis*, cited the three Forrest collections listed above, and believed these collections to be from Longchuan xian of Yunnan Province, China. Simultaneously, he mentioned that the species might belong in *Odontonemella* Lindau, but did not actually transfer the species from *Eranthemum* L. to *Odontonemella*. Hu (2002) included this species under *Pseuderanthemum* in her treatment of the family Acanthaceae for *Flora Reipublicae Popularis Sinicae* and indicated that it is distributed in the boundary areas between China and Burma (Myanmar).

Odontonemella was established by Lindau (1893), characterized by a ventricose corolla, two fertile stamens, two staminodes, and spangenpollen, and was typified by *O. indica* Lindau. *Odontonemella indica* was originally described in *Eranthemum* as *E. indicum* (Clarke, 1885) and was transferred to *Mackaya* by Ensermu et al. (1992). Lindau (1895) added a new member to the genus, *O. leptostachya* Lindau based on *Leptostachya wallichii* Nees, which is the lectotype of *Leptostachya* Nees (Hansen, 1985b; Deng & Xia, 2005) and does not fit the original description of *Odontonemella* given by Lindau (1895). Recent studies placed *Odontonemella* in synonymy with *Mackaya* (Brummitt, 1992; Ensermu et al., 1992; Mabberley, 1997; Scotland & Volessen, 2000).

In October 2004, the first author had the opportunity to check the material identified as *Pseuderanthemum tapingense* when he visited the herbaria of Kew and Edinburgh. In the Edinburgh herbarium, the first author saw all three collections cited by Smith, of which *G. Forrest 9655* was dissected by Smith. This collection clearly shows that the species has two fertile stamens and two staminodes. It is not *Pseuderanthemum* because of its campanulate corolla without a long cylindrical tube. It also differs from *Eranthemum* in the corolla shape, which is long and cylindrical in *Eranthemum* and campanulate in *Mackaya*, and in the pollen grains (Lindau, 1895; Hu,

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2002). After comparison with related genera, we concluded that the species belongs in *Mackaya* rather than in *Pseuderanthemum* or *Eranthemum*. Our recent molecular data (unpublished) also indicate that *Mackaya* forms a sister group with *Asystasia* Blume and forms paraphyletic groups with *Pseuderanthemum*. A new combination, *M. tapingensis* (W. W. Smith) Y. F. Deng & C. Y. Wu, is therefore necessary.

The genus *Mackaya* (Harvey, 1859) is characterized by its secund flowers, campanulate corolla, two fertile stamens, and two staminodes. Kanjilal and Das (1939) incorrectly included *Asystasia* in *Mackaya* and transferred three Assam species of *Asystasia* to *Mackaya*, i.e., *M. atroviridis* (T. Anderson) Das, *M. macrocarpa* (Nees) Das, and *M. neesiana* (Wallich) Das. These three species are quite different from *Mackaya* in having four stamens and we prefer to place them in *Asystasia* rather than *Mackaya*. In recent studies, however, *Mackaya* has been treated separately from *Asystasia* (Ensermu et al., 1992; Mabberley, 1997; Scotland & Vollesen, 2000; Wood, 2001). It was placed in subtribe Asystasieae (Bentham, 1876; Clarke, 1885; Lindau, 1895), tribe Odontonemeae (Lindau, 1895), or subtribe Justiciinae (Scotland & Vollesen, 2000) together with *Dicentranthera* T. Anderson, *Asystasiella* Lindau, *Glossochilus* Nees, and *Salpinctium* T. J. Edwards.

Mackaya is a small genus of three species with a disjunct range: *M. bella* Harvey is restricted to South Africa (Phillips, 1951), but *M. indica* (Nees) Ensermu occurs in India, Bhutan, Nepal, and Burma (Myanmar). *Mackaya tapingensis*, proposed herein, is found in southwestern Yunnan, China, and adjacent Burma (Myanmar).

Pollen morphology is one of the important characters defining the generic boundary in the family Acanthaceae (Lindau, 1893, 1895; Bremekamp, 1944). Pollen of *Mackaya tapingensis* is oblate-spheroidal, 3-colporate, and ellipsoidal with a perforate exine (polar axis [P] = 50.2 [46–53] μm; equatorial diameter [E] = 44.9 [42–48] μm) (Fig. 1). It is quite different from pollen of *Eranthemum* species but is similar to that of *Pseuderanthemum* species and other *Mackaya* species (Raj, 1961; Daniel, 1993, 1998; Scotland & Vollesen, 2000; Hu et al., 2005a, b). It differs from pollen of the other two species of *Mackaya* only in size (Ensermu et al., 1992).

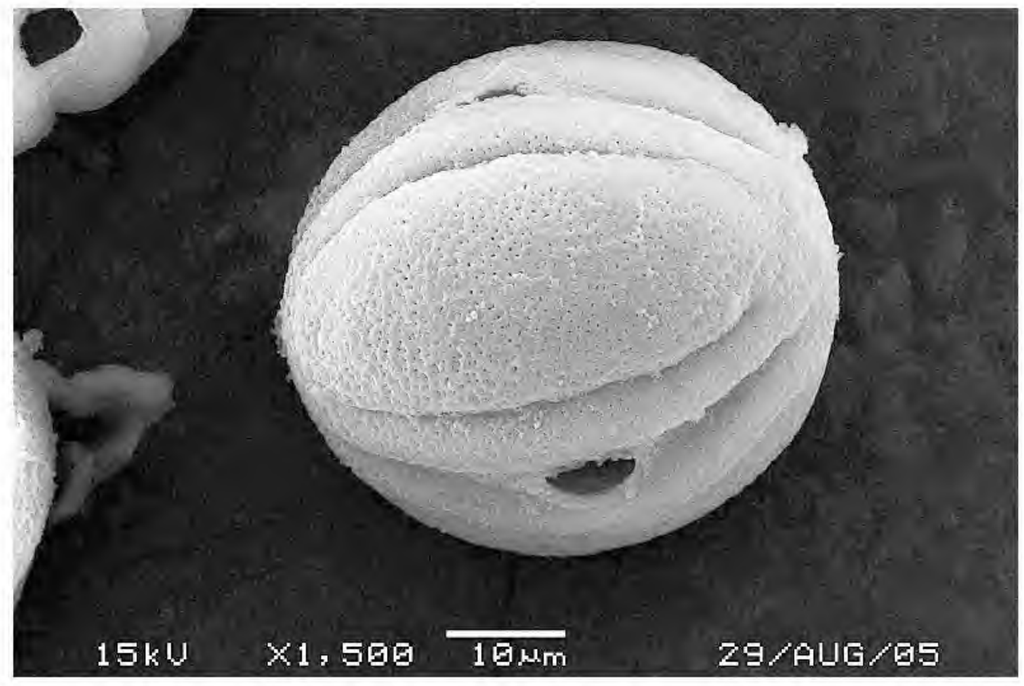

Figure 1. Pollen grain of *Mackaya tapingensis* (W. W. Smith) Y. F. Deng & C. Y. Wu from *G. Forrest 9655* (IBSC).

Mackaya tapingensis (W. W. Smith) Y. F. Deng & C. Y. Wu, comb. nov. Basionym: *Eranthemum tapingense* W. W. Smith, Notes Roy. Bot. Gard. Edinburgh 10: 177. 1918. *Pseuderanthemum tapingense* (W. W. Smith) C. Y. Hu & H. S. Lo, Fl. Hainan 4: 558. 1975. TYPE: Myanmar [Burma]: "Taping Valley, Upper Burma, lat. 24°20′N, 2000 ft., shrubby plant of 2–4 ft., flowers pale rose, in shady jungle," Feb. 1913, *G. Forrest 9655* (lectotype, designated here, E; duplicates, IBSC, K).

Distribution and habitat. The species is distributed in southwestern China (Yunnan) and Burma (Myanmar). It grows in shady habitat under forest at elevations of 600–1800 m.

Relationships. *Mackaya tapingensis* is similar to *M. indica*, but differs in its lanceolate (vs. elliptic) leaves and glabrous (vs. puberulent or glabrescent) calyx that is basally connate to 1/3–1/2 (vs. less than 1/5) (Smith, 1918; Hu, 2002).

Additional specimens examined. BURMA (MYANMAR). **Shan:** Valley of the Taping, *G. Forrest 9484* (E); Valley of the Taping, 2000 ft., *G. Forrest 12149* (E). CHINA. **Yunnan:** Gengma Xian, 2250 m, 7 Jan. 2006, *Deng Yunfei 18452* (IBSC); Lu-se (now Luxi Shi), 1750 m, 3 Mar. 1934, *H. T. Tsai 56406* (IBSC, KUN); Lu-Hsi Hsien (now Luxi Shi), 1750 m, 9 Feb. 1934, *H. T. Tsai 56868* (IBSC, KUN, SZ); Yingjiang Xian, 900 m, 26 Oct. 1986, *Lin Qin 770760* (KUN); Yingjiang Xian, 1800 m, 19 Jan. 1989, *Sun Hang 1530* (KUN); Yingjiang Xian, 1450 m, Dec. 1981, *Tao Guoda 12791* (HITBC); Yingjiang Xian, 1500 m, 3 Nov. 1974, *Tao Guoda 13128* (HITBC, KUN); Yingjiang to Ruili, autumn 1952, *R. C. Ching 50112* (KUN, SWFC); Zhenkang Xian, 1130 m, 14 Feb. 1959, *Zhu Taiping 641* (KUN); western Yunnan, autumn 1952, *R. C. Ching 50633* (KUN, SWFC).

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A New Combination in *Pediomelum* and a New Genus, *Ladeania*, from Western North America (Fabaceae, Psoraleeae)

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Abstract. *Psoralidium tenuiflorum* (Pursh) Rydberg, the type of *Psoralidium* Rydberg, is transferred to *Pediomelum* Rydberg requiring a new combination, *Pediomelum tenuiflorum* (Pursh) A. N. Egan in tribe Psoraleeae Lowe (Fabaceae/Leguminosae). Previously published evidence on phylogenetic relationships provides a foundation for this combination, as do shared morphological traits such as persistent bracts and an elliptical fruit that falls with the calyx. A new genus, *Ladeania* A. N. Egan & Reveal, is described to accommodate the two remaining species previously in *Psoralidium*: *L. juncea* (Eastwood) A. N. Egan & Reveal and *L. lanceolata* (Pursh) A. N. Egan & Reveal, with the latter designated as the type. *Ladeania* is distinguished by readily deciduous bracts accompanying a calyx that does not enlarge or elongate in fruit, but flares back from the receptacle. A lectotype is designated for *Psoralea floribunda* Nuttall ex Torrey & A. Gray.

Key words: Fabaceae, IUCN Red List, *Ladeania*, Leguminosae, North America, *Pediomelum*, Psoraleeae, *Psoralidium*.

Psoralidium tenuiflorum (Pursh) Rydberg was first collected on the historical expedition of Meriwether Lewis and William Clark on 21 September 1804 at the Big Bend of the Missouri River, which would later become Lyman County, South Dakota, U.S.A. (Moulton, 1987; Reveal et al., 1999). The species is widespread across much of the Great Plains of the United States (The Great Plains Flora Association, 1986). Frederick Pursh (1813) later described it as *Psoralea tenuiflora* Pursh. Since then, the species has experienced a murky taxonomic history. Rydberg (1919) designated *Psoralea tenuiflora* as the type of a new genus, *Psoralidium* Rydberg, wherein he recognized 14 species. Four of Rydberg's species, *Psoralidium floribundum* (Nuttall) Rydberg, *Psoralidium bigelovii* Rydberg, *Psoralidium batesii* Rydberg, and *Psoralidium obtusilobum* (Torrey & A. Gray) Rydberg, were later assigned to synonymy under *Psoralidium tenuiflorum* by Grimes (1990). Both Grimes and Isely (1998) recognized that the variation across this species is great, but with no distinct segregation as to definitively allow specific designation, an ascertainment that the authors of this paper share.

Recently, Egan and Crandall (2008) conducted a comprehensive phylogenetic analysis of North American members of tribe Psoraleeae Lowe, to which *Psoralidium* and *Pediomelum* Rydberg belong. Their study estimated evolutionary relationships within North American Psoraleeae across eight DNA regions: ITS, *Waxy*, *trnS/G*, *trnL/F*, *trnK*, *matK*, *trnD/T*, and *rpoB-trnC*. All analyses therein suggested that *Psoralidium*, as circumscribed by Grimes (1990), was not a natural grouping and that *Psoralidium tenuiflorum* nested well within *Pediomelum*. In addition, both accessions included in their analyses grouped together within a well-supported clade consisting predominately of species ascribed to subgenus *Pediomelum* by Grimes (see Egan & Crandall, 2008: figs. 2, 3).

Grimes (1990) diagnosed *Psoralidium* by its unique calyx morphology that does not enlarge in fruit, but instead flares back and tears along a lateral sinus. While *Psoralidium tenuiflorum* possesses similar calyx morphology, some of its other traits suggest an affinity with *Pediomelum*. The remaining two species that Grimes assigned to *Psoralidium*, *P. lanceolatum* (Pursh) Rydberg and *P. junceum* (Eastwood) Rydberg, possess readily deciduous bracts and globose to subglobose fruits that are deciduous above the receptacle, while *Psoralidium tenuiflorum* has persistent bracts and an elliptical fruit that falls with the calyx, traits more similar to those of *Pediomelum*. In preparation for the forthcoming treatment of Fabaceae for the *Flora of North America*, *Psoralidium tenuiflorum* is transferred from *Psoralidium* to *Pediomelum* on the basis of the above phylogenetic and morphological data.

With the transfer of the type species of *Psoralidium* (Rydberg, 1919), based on *Psoralea tenuiflora* (Pursh, 1813), to *Pediomelum*, the remaining two species assigned to that genus, *Psoralidium junceum* and *Psoralidium lanceolatum*, require a new generic name. We resolve this issue by describing the new genus *Ladeania* A. N. Egan & Reveal with two new combinations: *L. juncea* (Eastwood) A. N. Egan &

Reveal and *L. lanceolata* (Pursh) A. N. Egan & Reveal, with the latter designated as the type.

Pediomelum tenuiflorum (Pursh) A. N. Egan, comb. nov. Basionym: *Psoralea tenuiflora* Pursh, Fl. Amer. Sept. 2: 475. Dec. 1813. *Lotodes tenuiflorum* (Pursh) Kuntze, Revis. Gen. Pl. 1: 194. 1891, nom. illeg. *Psoralidium tenuiflorum* (Pursh) Rydberg, N. Amer. Fl. 24: 15. 1919. TYPE: U.S.A. South Dakota: Lyman Co., Big Bend of the Missouri River, 21 Sep. 1804, *M. Lewis s.n.* (lectotype, designated by Grimes, 1990: 36, PH-LC 184; duplicates, NY [fragm.], PH-LC 183).

Psoralea floribunda Nuttall ex Torrey & A. Gray, Fl. N. Amer. 1: 300. 1838. *Lotodes floribundum* (Nuttall ex Torrey & A. Gray) Kuntze, Revis. Gen. Pl. 1: 194. 1891, nom. illeg. *Psoralea tenuiflora* var. *floribunda* (Nuttall ex Torrey & A. Gray) Rydberg, Bot. Sem. Univ. Neb. [= Fl. Nebr., Rosales] 21: 55. 1895. *Psoralidium floribundum* (Nuttall ex Torrey & A. Gray) Rydberg, N. Amer. Fl. 24: 15. 1919. TYPE: U.S.A. "Arkansas" [probably southeastern Oklahoma]: Aug. 1819, *T. Nuttall s.n.* (lectotype, designated here, NY [26777]).

The NY specimen of *Psoralea floribunda* was chosen as the lectotype based on the fact that it was annotated by Nuttall, who stated that it was collected in the Arkansas Territory; the sheet also bears a small sketch by Torrey proving that he examined the material. The combination of these factors makes this specimen a good choice for lectotypification of *P. floribunda*.

Distribution and habitat. This species occurs widely across North America, mostly within the Great Plains of the United States, but also in desert shrub and woodlands at 200–1800 m elevation, from Montana east to Minnesota and south to Texas and northern Mexico (see Grimes [1990] and Isely [1998] for comprehensive maps of species distribution).

IUCN Red List category. We suggest that *Pediomelum tenuiflorum* be designated as a taxon of Least Concern (LC) according to the IUCN Red List Categories and Criteria (IUCN, 2001) due to its widespread distribution and presence in both natural and disturbed habitats.

Relationships. Molecular phylogenetic studies place *Pediomelum tenuiflorum* well within the subgenus *Pediomelum* as circumscribed by Grimes (1990). Morphology supports this placement in that *P. tenuiflorum* has a tall, branched habit with a persistent inflorescence, characteristics that distinguish subgenus *Pediomelum* from subgenus *Disarticulatum* J. W. Grimes.

Pediomelum tenuiflorum fits easily into the key for *Pediomelum* provided by Grimes (1990: 58) with the reformatting and addition of a new couplet to his couplet 6:

6a. Calyx 2.5–6 mm to lower tooth; peduncle always greater than 7 mm . . . . . 6′a
6′a. Pedicel in flower 3.5–10 mm long. . . . . *Pediomelum linearifolium*
6′b. Pedicel in flower 1.5–3 mm long. . . . . *Pediomelum tenuiflorum*
6b. Calyx 5.5–19 mm to lower tooth; if as short as 5.5 mm, then peduncle 7 mm or less.

Ladeania A. N. Egan & Reveal, gen. nov. TYPE: *Psoralea lanceolata* Pursh [≡ *Ladeania lanceolata* (Pursh) A. N. Egan & Reveal].

Genus novum quod a *Pediomelo* Rydberg bracteis cito caducis et calyce e receptaculo reflexo sed nec amplificato nec elongato tempore fructificante, a *Rupertia* J. W. Grimes receptaculo complanato (nec tumido) differt.

Plants herbaceous, usually much-branched and glandular, arising from rhizomes or from deep, woody roots. *Stems* usually much-branched basally, mostly sparingly so apically, glabrate or sericeous to densely pubescent throughout or at least basally, occasionally becoming glabrate with age, green, smooth or lightly striate, occasionally distinctly ribbed apically, lowermost portions often with thin, tan to brown cataphylls. *Leaves* palmately compound or pseudopalmate, (1 to)3- to 5-foliate; stipules quickly to tardily deciduous, usually adnate to petiole, rarely connate behind petiole, often modified to form cataphylls at base of stem; petioles not jointed to stem; leaflets petiolulate, persistent or quickly deciduous and sometimes lacking at maturity. *Inflorescence* an indeterminate, dense to interrupted pseudoraceme with (1 to)2(to 3) flowers per node; bracts lanceolate to rhombic, quickly deciduous. *Flowers* pedicellate; calyx with pallid green teeth or green throughout, glandular, sometimes glabrate to sericeous; teeth 5, usually less than half as long as calyx tube, mostly equal in length, the abaxial tooth sometimes slightly longer, flaring back and tearing along a lateral sinus in fruit; corolla papilionaceous, inserted on hypanthium rim, yellowish to purple-blue or dark purple, rarely white; banner reflexed 30°–90°, auriculate or not; wings and keel connate just above claw; wings dorsally lamellate on ventral side with a reflexed, dorsiventral lobe; keel fused apically; stamens diadelphous, the distinct portion of filaments filiform, in 2 series; anthers basifixed (upper series) and dorsifixed (lower series);

ovary 1-ovulate, short stipitate with stipe obscured by swollen hypanthial nectaries; style ± reflexed. *Fruit* an indehiscent, 1-seeded legume, circular, deciduous above receptacle; *seed* round to elliptic, somewhat compressed, brown, smooth.

Etymology. This genus is named in honor of LaDean Egan (1949–), mother of the senior author, in recognition of her steadfast support during numerous field-collecting trips throughout the course of her daughter's study of North American Psoraleeae.

Relationships. Recent molecular phylogenetic work placed *Ladeania* as most closely related to *Rupertia* (Egan & Crandall, 2008). Morphology supports this conclusion in that both are characterized as having deciduous bracts and a fruit that is deciduous above the receptacle; they differ in calyx and leaf morphology as well as in the receptacle being tumid in *Rupertia* and flat in *Ladeania.*

The following key (modified from Grimes, 1990) distinguishes *Ladeania* from other genera of New World Psoraleeae. This key should be inserted in Grimes' key (1990: 16) so as to replace couplets 4 through 8.

4a. Fruit developing an internal wall of sclereids at maturity; calyx not enlarging, elongating, or changing shape during fruiting . . . . . *Hoita*
4b. Fruit not developing an internal wall of sclereids at maturity; calyx changing shape and/or enlarging, elongating during fruiting. 5
5a. Calyx not enlarging or elongating through fruiting, but flaring back widely from receptacle, this accompanied by readily deciduous bracts . . . *Ladeania*
5b. Calyx enlarging or elongating, if only slightly, commonly inflating somewhat; if calyx not enlarging or elongating and flaring back, then accompanied by persistent bracts 6
6a. Pericarp rugose, glabrous (glabrate). . . . . *Orbexilum*
6b. Pericarp not rugose, usually pubescent, rarely glabrate. 7
7a. Bracts persistent; fruit persistent on receptacle . . . . . *Pediomelum*
7b. Bracts deciduous; fruit deciduous above receptacle . . . 8
8a. Receptacle tumid; corolla ochroleucous or yellow . . . . . *Rupertia*
8b. Receptacle flat; corolla blue, purple, or violet . . . . . *Otholobium*

The following key distinguishes between the two species in the genus *Ladeania*:

1a. Mature stems rushlike, leafless or with only a few basal leaves; peduncle 15–40 cm long or more; calyx 3–4 mm long . . . . . *L. juncea*
1b. Mature stems not rushlike, with numerous leaves; peduncle 1–14 cm long; calyx 2–2.5 mm long. . . . . *L. lanceolata*

1. Ladeania lanceolata (Pursh) A. N. Egan & Reveal, comb. nov. Basionym: *Psoralea lanceolata* Pursh, Fl. Amer. Sept. 475. 1814 [actual date, Dec. 1813]. *Psoralidium lanceolatum* (Pursh) Rydberg, N. Amer. Fl. 24: 13. 1919. TYPE. U.S.A. Along the Missouri River, 1811, *T. Nuttall s.n.* (lectotype, designated by Grimes, 1989: 22, PH-LC 182; duplicate, NY [PH-LC fragm.]). Figure 1.

Although traditionally the type was considered to have been collected by Meriwether Lewis in 1804, Reveal et al. (1999: 42) showed that this sheet could only have been gathered by Thomas Nuttall in 1811. If indeed Pursh had *Lewis 42* in hand prior to 1813, that specimen is now lost and Grimes' typification is an effective lectotypification (Barneby, 1989). This species is quite variable among a number of its morphological characters across its wide distribution (see Fig. 1). While some geographic trends exist within the species, most traits are continuous with intermediates seemingly disbanding any coherency of morphologically diagnostic traits. In agreement with Grimes (1990) and Isely (1998), we abstain from recognizing any varieties across the range of this species. Specific and varietal nomenclature is synonymized by Grimes (1990).

Distribution and habitat. The species is widespread across the western Great Plains and throughout the Intermountain West in the United States, from Washington east to North Dakota, south to the Texas Panhandle and west to Arizona. It is also found in adjacent Canada. It flourishes in sandy soils, but is found less often on semistabilized soils of sagebrush communities (see Grimes [1990] and Isely [1998] for comprehensive maps of species distribution).

IUCN Red List category. We recommend that this species be listed as Least Concern (LC) under the IUCN Red List Categories and Criteria (IUCN, 2001) due to its widespread distribution and presence within several habitats across the Great Plains and Intermountain West.

2. Ladeania juncea (Eastwood) A. N. Egan & Reveal, comb. nov. Basionym: *Psoralea juncea* Eastwood, Proc. Calif. Acad. Sci., ser. 2, 6: 286. 1896 [1897]. *Psoralidium junceum* (Eastwood) Rydberg, N. Amer. Fl. 24: 17. 1919. TYPE. U.S.A. Utah: San Juan Co., Epsom Creek, 13 July 1895, *A. Eastwood 21* (lectotype, designated by Grimes, 1989: 21, CAS; duplicates, CAS, GH, MO, NY).

Although Grimes (in Barneby 1989: 21) termed the CAS specimen a "holotype"—as he did the Nuttall specimen of *Psoralea lanceolata* at PH, this is to be corrected to a lectotype. As Grimes pointed out (see also Grimes, 1990: 33), Eastwood made no reference

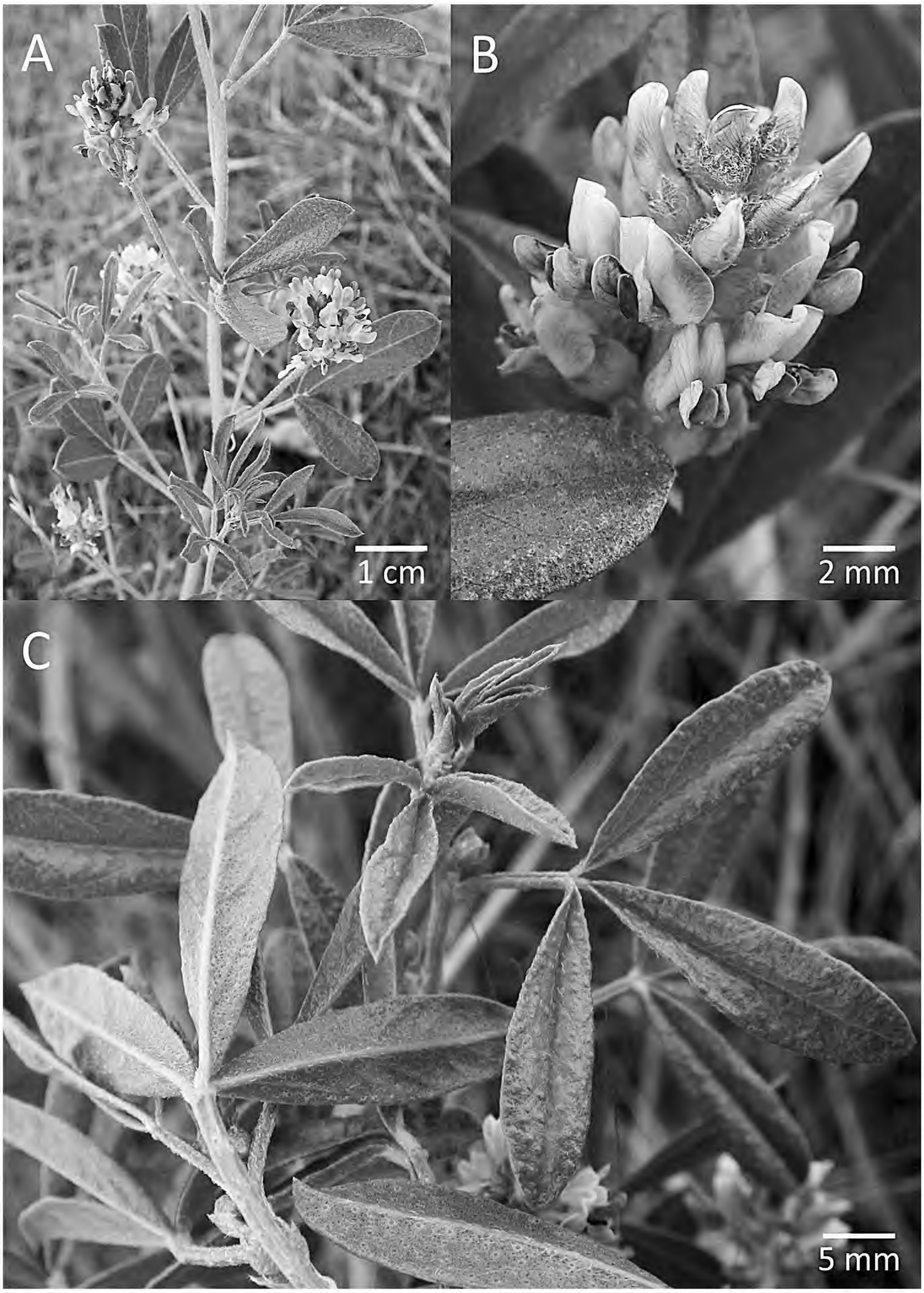

Figure 1. *Ladeania lanceolata* (Pursh) A. N. Egan & Reveal. —A. Axillary inflorescences with leaves and stem of plant. —B. A single inflorescence showing calyces and floral parts. —C. Leaves. Photographs used by permission of the photographer, Ben Legler. Photographs were taken of plants in Washington State and represent the morphological diversity found in the northwest portion of the species range.

to any collection in 1897. Nonetheless, her collection is original material and its individual specimens qualify as syntypes from which a lectotype is to be designated.

Distribution and habitat. The species is known only from sand dunes or semistabilized sandy substrates in desert shrub communities along the Colorado River and its tributaries in Kane and San

Juan counties of Utah, as well as Coconino County, Arizona (see Grimes [1990] and Isely [1998] for comprehensive maps of species distribution).

IUCN Red List category. We recommend that this species be listed as Vulnerable (VU) under the IUCN Red List Categories and Criteria (IUCN, 2001) based on the fact that its geographic range is estimated to be less than 20,000 km^2. *Ladeania juncea* is restricted to sandy habitats mainly within the southern portions of Kane and San Juan counties in Utah. A few reports of the species are listed from Garfield County, Utah, as well as a few from Coconino County, Arizona, where it is much more sparsely distributed. While this species may be locally abundant, fruit is set infrequently (Isely, 1998). In addition, over a portion of its range, the quality of its habitat is in decline due to infringement of grazing and recreational use.

Acknowledgments. Many thanks go to LaDean Egan for assistance in collecting these and many other Psoraleeae species across North America. We thank Marty F. Wojciechowski, Billie L. Turner, an anonymous reviewer, and the scientific editor of *Novon*, Victoria C. Hollowell, for helpful comments on an earlier version of this manuscript. We are thankful to Ben Legler for allowing us to use his photographs.

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Nomenclatural Changes for *Monardella* (Lamiaceae) in California

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Abstract. Nomenclatural changes in *Monardella* Bentham (Lamiaceae) are introduced to more accurately circumscribe the specific and subspecific entities in the genus in California. Examination of herbarium specimens and digital images and analysis of biogeographical data from additional fieldwork has revealed morphological continuities and discontinuities. Four new species are described: *M. boydii* A. C. Sanders & Elvin, *M. eremicola* A. C. Sanders & Elvin, *M. mojavensis* Elvin & A. C. Sanders, and *M. sinuata* Elvin & A. C. Sanders. Five new subspecies are described: *M. australis* Abrams subsp. *jokerstii* Elvin & A. C. Sanders, *M. hypoleuca* A. Gray subsp. *intermedia* A. C. Sanders & Elvin, *M. linoides* A. Gray subsp. *sierrae* Elvin & A. C. Sanders, *M. sinuata* subsp. *nigrescens* Elvin & A. C. Sanders, and *M. undulata* Bentham subsp. *arguelloensis* Elvin & A. C. Sanders. Eight new combinations and/or rank changes are proposed: *M. australis* subsp. *cinerea* (Abrams) A. C. Sanders & Elvin, *M. breweri* A. Gray subsp. *glandulifera* (I. M. Johnston) Elvin, *M. breweri* subsp. *lanceolata* (A. Gray) A. C. Sanders & Elvin, *M. breweri* subsp. *microcephala* (A. Gray) Elvin & A. C. Sanders, *M. linoides* subsp. *anemonoides* (Greene) Elvin & A. C. Sanders, *M. linoides* subsp. *erecta* (Abrams) Elvin & A. C. Sanders, *M. undulata* subsp. *crispa* (Elmer) Elvin & A. C. Sanders, and *M. venosa* (Torrey) A. C. Sanders & Elvin. The description of one taxon is emended: *M. undulata* subsp. *undulata*. Lectotypes are designated for *M. lanceolata* A. Gray and *M. sanguinea* Greene. We address each of these changes within informal species groupings or alliances.

Key words: California, Lamiaceae, *Monardella*.

Preparation of a treatment of the genus *Monardella* Bentham (Lamiaceae) for the second edition of *The Jepson Manual: Higher Plants of California* (Hickman, 1993) has revealed the need for multiple nomenclatural changes and the description of new taxa. In this paper, we primarily discuss taxa that occur in southern and central California and their relationships. We did not comprehensively analyze taxa in the *M. villosa* Bentham species complex. Below, we explain changes being made to the existing treatment of the California species of *Monardella* (Jokerst, 1993). Epling, in his 1925 monograph of the genus, grouped species according to their morphological resemblances within four sections. We organized the species into informal groupings that we refer to as species alliances.

The genus *Monardella* is widespread and rather complex, with over 50 taxa distributed among more than 30 annual and perennial species in western North America. *Monardella* has a center of distribution in California with approximately 45 taxa in 30 species. *Monardella* also occurs in Washington, Oregon, Idaho, Nevada, Utah, Colorado, Arizona, and New Mexico, U.S.A., and in Baja California, Mexico. Since 1834, there have been 198 combinations published that have been reshuffled from 93 protologues.

Taxonomically Important Characteristics in *Monardella*

The more informative morphological characters that have been used to distinguish taxa in *Monardella* include plant habit; leaf, bract, and inflorescence morphology; and pubescence (Gray, 1876, 1886; Abrams, 1912a, b, 1951; Epling, 1925, 1939; Jepson, 1925, 1943; Munz, 1935, 1959, 1974; Jokerst, 1993). The inflorescence in *Monardella* has been commonly called a head (Munz, 1959; Jokerst, 1993). However, it has a branched internal structure and the flowers are not sessile on the apex of the peduncle. It is technically a compact, capitate cyme or glomerule.

The glomerules in *Monardella* are immediately subtended by a series of bracts or modified leaves, and occasionally also by unmodified leaves. Bracts subtending individual flowers or inflorescence branches within the glomerule are occasional and

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much reduced. Leafy structures immediately subtending the glomerule are generally highly modified in *Monardella*, but are sometimes only slightly modified. This mix of unmodified leaves and the variability of bracts have caused difficulty in the identification of many *Monardella* specimens. The use of bract sets in separating species groups in *Monardella* was emphasized by Jokerst (1993), following on the work of Hardham (1966a, b; Hardham & Bartel, 1990), who emphasized this feature in the recognition of species. Unfortunately, the bracts in *Monardella* do not occur in discrete and static sets readily recognizable by an objective feature, but rather simply grade inward in the glomerule. The distinction between the outermost bracts and the uppermost leaves can be problematic. What some refer to as outer bracts are simply unmodified leaves immediately subtending the glomerule. In some species of *Monardella*, the bases of the outermost bracts may be broad, thick, and pale, while the distal halves are green and leafy with narrow tips. The number of bracts per plant/species is not fixed. However, there are bract morphological characters that are stable, informative, and important in differentiating between taxa (e.g., length, width, pubescence).

Monardella Bentham, Labiat. Gen. Spec. 331. 1834. TYPE: *Monardella odoratissima* Bentham, Labiat. Gen. Spec. 332. 1834.

SPECIES ALLIANCES IN *MONARDELLA*

Epling (1925) grouped taxa according to their morphological resemblances within four "Sections": Section I, Macranthae; Section II, Annuae; Section III, Villosae; and Section IV, Odoratissimae. We present the species discussed in this paper within informal groupings that we refer to as species alliances. We recognize Epling's four sections within our alliances plus two additional ones, Undulatae and Australae. Species of the Undulatae Alliance are subshrubs to shrubs with woody stems and leaves that have wavy to undulate edges. Species in the Villosae Alliance are caespitose to erect suffrutescent perennials to subshrubs with woody stems that are moderately to densely pubescent with some trichomes longer than 0.5 mm. Species in the Australae Alliance are rhizomatous to mat-forming suffrutescent perennials with woody stems with some trichomes longer than 0.5 mm. Species in the Odoratissima Alliance are caespitose to erect, suffrutescent perennials to subshrubs with woody stems that are glabrous to slightly pubescent with trichomes shorter than 0.5 mm. Species in the Annuae Alliance are erect annuals with herbaceous stems.

I. UNDULATAE ALLIANCE

The Undulatae Alliance consists of perennial species that possess leaves with distinct undulate margins and that are associated with coastal dunes and scrub in Santa Barbara and San Luis Obispo counties in central California. This is a group of three closely allied taxa, two of which have been treated both as distinct species and as subtaxa within *Monardella undulata* Bentham (Bentham, 1834; Jepson, 1901, 1925, 1943; Elmer, 1905; Abrams, 1912a, b, 1951; Epling, 1925; Hoover, 1949, 1970; Munz, 1959; Jokerst, 1992, 1993). This alliance contains one species, *M. undulata*, with three subspecies, all of which are subshrubs or shrubs.

1. Monardella undulata Bentham, Labiat. Gen. Spec. 332. 1834. TYPE: U.S.A. California: 1833, *Douglas s.n.* (holotype, K [digital image]; isotype, GH).

Discussion. The application of the name and circumscription of *Monardella undulata* needs clarification because the original description (Bentham, 1834) contains characters from more than one taxon. It describes a perennial with leaves that are crisped to undulate, but refers to some characters that correspond with *M. crispa* Elmer such as the procumbent basal stems ("caule basi procumbente"). The sheets with the type contain collections of more than one taxon. The name *M. undulata* has long been applied, in part, to an annual plant with undulate leaf margins that grows in sandy soils along the coast of central California. This annual plant is not the species represented by the original description (Bentham, 1834) or by the type specimens. In his description of *M. undulata*, Bentham (1834) specifically described a plant that has a perennial or suffrutescent base or trunk, but included characters that apply to two different perennial species. Therefore, the description needs to be emended to contain characters representative of only one taxon.

1a. Monardella undulata Bentham subsp. **undulata**.

Monardella undulata Bentham var. *frutescens* Hoover, Leafl. W. Bot. 5: 179. 1949, syn. nov. *Monardella frutescens* (Hoover) Jokerst, Phytologia 72: 10. 1992. TYPE: U.S.A. California: San Luis Obispo Co., N edge of Santa Maria Valley on Arroyo Grande-Guadalupe Rd., 10 July 1947, *R. F. Hoover 7289* (holotype, OBI; isotype, CAS).

Subshrub, suffrutescent, strongly scented, 30–70 cm tall, stems woody at base, often pubescent,

spreading or appressed puberulent; branches ascending to erect. Leaves clustered at nodes, 10–30 × 2–4 mm, linear to narrowly (ob)lanceolate, thin, sparsely pubescent, green, margins wavy, petioles subsessile, to 7 mm. Inflorescence generally 1 glomerule per main stem, 10–20 mm wide; bracts 7–10 × 3–5 mm, lanceolate to narrowly ovate, thin, papery, straw-colored or purple. Calyx 4–6 mm, lobes acute, spreading to ascending pubescent, tube less pubescent, distinctly pedicellate, ca. 1 mm, within the glomerule; corolla blue-purple; stamens exserted, upper lobes gland-tipped; anthers purple.

Discussion. We examined the isotype sheet from GH (Fig. 1) and a high-resolution digital image of the holotype sheet from K. The holotype sheet contains fragments from two collections: *Hartweg s.n.* (1848, two pieces on the left) and *Douglas s.n.* (1833, two pieces on the right). The upper right-hand fragment is from a perennial plant and clearly shows more than one season's growth. The other fragment in the Douglas collection could be from an annual plant, but on close examination appears more consistent with new growth as on other specimens of this perennial. The isotype sheet contains fragments from three collections: *W. H. Brewer 421* (two pieces on the left), *Douglas s.n.* (undated, one fragment in the center), and *Andrews s.n.* (undated, one fragment on the right). The isotype of the Douglas collection matches the upper right-hand holotype fragment, which is from a perennial plant showing more than one season's growth.

The name *Monardella undulata* was first misapplied to an annual plant with undulate leaf margins by Asa Gray in his description of *M. leucocephala* A. Gray (Gray, 1867). He carried this error forward in his 1876 treatment of the genus, which also included a key (Gray, 1876). This erroneous treatment was later adopted by Jepson (1901, 1925, 1943); Abrams (1912a, b); Epling (1925); Hoover (1949, 1970); McMinn, who omits *M. undulata* as a perennial (1939); Howell (1970); Smith (1998); Jokerst (1993); and Matthews (1997). The annual *Monardella* plants with undulate leaves, which have been called *M. undulata* since 1867, have, therefore, never been formally described. These plants are treated below in the Annuae Alliance.

The type specimens of *Monardella undulata* correspond with the plant that has been known as *M. undulata* Bentham var. *frutescens* Hoover and more recently as *M. frutescens* (Hoover) Jokerst, making *M. frutescens* a junior synonym of *M. undulata*. The description and type collection of *M. undulata* are inseparable from *M. frutescens* in plant habit, branching pattern, leaf shape and pubescence, stem pubescence, and bract morphology.

Distribution, ecology, and phenology. *Monardella undulata* subsp. *undulata* is endemic to San Luis Obispo County, California. It grows on relictual and/or stabilized sand dunes slightly removed from the immediate coast from Pismo Beach south to the Santa Maria River. It generally flowers from April through November.

Related taxa. *Monardella undulata* subsp. *undulata* differs from *M. crispa* in that its stems are woody and erect to ascending, branching from above with numerous secondary and tertiary branches, and commonly flowering on secondary branches. It has narrower oblanceolate (and less pubescent) leaves. *Monardella undulata* subsp. *undulata* intergrades freely with *M. crispa* in intermediate habitats where the two come into contact (e.g., *C. B. Hardham 12891*, SBBG; *R. F. Hoover 6527*, CAS, OBI; *D. D. Keck 2211*, CAS, DS). There are no apparent intermediate or hybrid specimens between *M. undulata* subsp. *undulata* and the *Monardella* annual (described below) that has undulate leaf margins and occurs in the same general region.

1b. Monardella undulata Bentham subsp. **arguelloensis** Elvin & A. C. Sanders, subsp. nov. TYPE: U.S.A. California: Santa Barbara Co., Central Coast, Vandenberg Air Force Base, S base on flats/mesa ESE of Point Arguello, NE of Rocky Point, SW of Cypress Ridge, E of Ocean Rd., 34°34′16.1″N, 120°37′57.3″W, 110 m, coastal bluff scrub and grasslands on relictual sand dunes, 29 June 2007, *M. A. Elvin & L. Lum 5505* (holotype, UCSB; isotypes, ARIZ, BRY, CAS, CHSC, F, GH, HSU, IRVC, JEPS, K, MO, NY, OBI, RSA, SBBG, SD, UCR, US). Figure 2.

Haec subspecies ab omnibus ceteris subspeciebus habitu frutescente, a *Monardella undulata* Bentham subsp. *undulata* foliis tenuiter pubescentibus, caule crassiusculo magis pubescente et glomerulis magnis, a *M. undulata* subsp. *crispa* (Elmer) Elvin & A. C. Sanders habitu erecto et foliis pubescentibus minoribus angustis differt.

Shrub, 30–100 cm tall, erect; primary axis stout, to 3.5 cm diam., woody at base, multi-branched above, stems sparsely to moderately pilose. Leaves 10–40 × 3–7 mm, narrowly lanceolate with an obtuse tip to narrowly oblanceolate, ± fleshy, margins strongly undulate, green. Inflorescence an open compound cyme; glomerules solitary on primary and secondary branches, 18–30 mm wide; bracts 9–13 × 5–9 mm, lanceolate to narrowly ovate, acuminate, scarious or purple-tinged. Calyx sparsely to moderately hispid, pubescence denser at apex; corolla 10–12 mm, rose to purple.

Figure 1. *Monardella undulata* subsp. *undulata*, isotype, center (*Douglas s.n.* [1 piece]); left, *Monardella* annual (not *M. undulata*; *Brewer 421* [2 pieces]); and right, *Monardella* annual (not *M. undulata*; *Andrews s.n.* [1 piece] [GH]).

Distribution, ecology, and phenology. *Monardella undulata* subsp. *arguelloensis* is closely related to subspecies *undulata* and *M. crispa*, sharing similar leaf and bract morphologies. *Monardella undulata* subsp. *arguelloensis* is a narrow endemic that only occurs in the immediate vicinity of Point Arguello in Santa Barbara County, California. Subspecies *arguelloensis* grows on relictual, stabilized sand dunes at 50–150 m and flowers from May through September.

Figure 2. *Monardella undulata* subsp. *arguelloensis* Elvin & A. C. Sanders (holotype, *M. A. Elvin 5505*, UCSB). Image by David Pereksta.

Etymology. The specific epithet refers to the type locality, to which it is endemic, Point Arguello, Santa Barbara County, California.

Related taxa. *Monardella undulata* subsp. *arguelloensis* is distinguished from the other subspecies of *M. undulata* by its habit and larger stature, although it shares similar leaf and bract morphologies. The main stem, or trunk, in subspecies *arguelloensis* is stout, erect, and up to 3.5 cm in diameter. This taxon, without a doubt, includes the largest plants in

Monardella. The central stems of subspecies *undulata* are slender, erect, and less than 1.5 cm in diameter. Primary stems in *M. crispa* are stout but decumbent, while only its secondary stems are erect and slender. No hybrid or introgressant plants have been observed between subspecies *arguelloensis* and subspecies *crispa*.

Paratypes. U.S.A. **California:** Santa Barbara Co., *M. A. Elvin 4955* (IRVC, UCR), *5511* (CAS, IRVC, MO, US), *5514* (IRVC), *5518* (GH, IRVC, NY, UCR), *D. E. Hickson 40* (CHSC), *41* (CHSC), *44* (SBBG), *218* (SBBG), *223* (SBBG), *224* (SBBG), *227* (SBBG), *A. P. Griffiths s.n.* (OBI 58363), *s.n.* (OBI 58404), *s.n.* (OBI 58445), *s.n.* (OBI 58446), *s.n.* (OBI 58447), *s.n.* (OBI 58448), *18133* (OBI), *D. Keil 19382* (OBI, SBBG), *C. F. Smith 12621* (SBBG).

1c. Monardella undulata Bentham subsp. **crispa** (Elmer) Elvin & A. C. Sanders, stat. nov. Basionym: *Monardella crispa* Elmer, Bot. Gaz. 39: 46. 1905. *Monardella undulata* Bentham var. *crispa* (Elmer) Epling, Ann. Missouri Bot. Gard. 12: 77. 1925. TYPE: U.S.A. California: Santa Barbara Co., Surf, May 1902, *A. D. E. Elmer 3965* (holotype, DS not seen; isotypes, DS, MO not seen, US not seen).

Distribution, ecology, and phenology. *Monardella crispa* is reduced to a subspecies of *M. undulata* because it overlaps in range with subspecies *undulata* and freely intergrades with subspecies *undulata* in intermediate habitats (e.g., partially stabilized dunes) where they overlap in San Luis Obispo County. Subspecies *crispa* grows on active dunes along the immediate coast from Pismo Beach, San Luis Obispo County, California, south to Honda, Santa Barbara County (ca. five miles south of Surf, the type location). It is similar to other active dune, perennial species in that it has decumbent branches that grow to stay above the shifting sands. Subspecies *crispa* is moderately to densely lanate on the stems, leaves, bracts, and calyces. The leaves appear pale green or glaucous and are oblong to oblong-linear, with undulate to crisped margins. Mature leaves are usually 7–10 mm wide. The solitary glomerules occur on the primary decumbent stems early in the season. Small, sterile, erect secondary branches occur along the primary stem, which can flower later in the season. It mainly flowers from April through September.

II. VILLOSAE ALLIANCE

The Villosae Alliance consists of perennials and subshrubs that occur in many plant communities from Washington, south through Oregon and California, U.S.A., to Baja California, Mexico. It is a widely divergent group of taxa with incipient speciation occurring throughout its range. Species in this alliance that occur in California include *Monardella hypoleuca* A. Gray (including three subspecies), *M. saxicola* I. M. Johnston, *M. siskiyouensis* Hardham, *M. sheltonii* Torrey (as "*sheltoni*"), *M. villosa* (including three subspecies), and *M. viridis* Jepson.

1. Monardella hypoleuca A. Gray, Syn. Fl. N. Amer. 2: 356. 1878. TYPE: U.S.A. California: southern California, 1876, *C. C. Parry & J. G. Lemmon 330* (holotype, GH not seen; isotypes, MO, NY [2]).

Discussion. *Monardella hypoleuca* is best distinguished by its bicolored leaves, usually with revolute margins. It occurs in chaparral, coastal sage scrub, and pine forest communities in central California (Santa Barbara County), U.S.A., south to northern Baja California, Mexico. It appears to intergrade with *M. villosa* at the northern edge of its range.

1a. Monardella hypoleuca A. Gray subsp. **hypoleuca**.

Distribution. *Monardella hypoleuca* subsp. *hypoleuca* is found in the western Transverse Ranges, specifically the Santa Monica, Santa Ynez, and Sierra Madre mountains of Los Angeles and Santa Barbara counties, California.

We alter the circumscription of *Monardella hypoleuca* subsp. *hypoleuca* only in removing the Santa Ana Mountains populations that have sometimes been included here to a new subspecies described below.

1b. Monardella hypoleuca A. Gray subsp. **intermedia** A. C. Sanders & Elvin, subsp. nov. TYPE: U.S.A. California: Orange Co., Santa Ana Mtns., upper Holy Jim Canyon, along trail in switchbacks, 33°41′50″N, 117°31′17″W, 976 m, thick chaparral, 2 Sep. 2005, *A. C. Sanders & M. A. Elvin 31615* (holotype, RSA; isotypes, GH, IRVC, JEPS, MO, SD, UCR, US). Figure 3.

Haec subspecies inter *Monardellam hypoleucam* A. Gray subsp. *hypoleucam* et subsp. *lanatam* (Abrams) Munz quoad aspectum et foliorum formam intermedia, a hac foliis supra subglabris vel parce pubescentibus et caule parce pubescente, ab illa foliis angustis valde revolutis differt.

Perennial, tufted to matted, rhizomatous, 10–35 cm tall, sparsely short-pubescent. Leaves 20–50 × 5–9 mm, narrowly lanceolate to lanceolate, adaxial surface subglabrous to sparsely pubescent, ± arched between revolute margins, abaxial surface tomentose. Inflorescence generally solitary; glomerules 20–

Figure 3. *Monardella hypoleuca* subsp. *intermedia* A. C. Sanders & Elvin (isotype, *A. C. Sanders 31615*, UCR).

35 mm wide; bracts 9–13 × 4–7 mm, ovate to lanceolate. Calyx 7.5–8.5 mm; corolla 14–17 mm, white to lavender, lobes obtuse; stamens exserted.

Distribution, ecology, and phenology. *Monardella hypoleuca* subsp. *intermedia* occurs in mountains and foothills at elevations of 400–1250 m, from the Santa Ana Mountains in Orange County on the north to the San Luis Rey River Valley on the south, an area that spans portions of Orange, Riverside, and San Diego counties. It generally occurs as an understory species in chaparral, oak woodland, and occasionally coniferous forest. It is a rather localized taxon and is uncommon throughout its range in the Santa Ana and

Palomar mountains, but it can appear to be locally common due to its rhizomatous habit. Subspecies *intermedia* shares with subspecies *hypoleuca* relatively glabrous adaxial leaf surfaces and sparse stem pubescence, but it has the narrow and strongly revolute leaf shape of subspecies *lanata*. It flowers from April through September.

Etymology. The specific epithet refers to the intermediate leaf morphology, appearance, and geographic distribution of this taxon relative to *Monardella hypoleuca* subsp. *hypoleuca* and *M. hypoleuca* subsp. *lanata*.

Related taxa. We considered the treatment of the three subspecies of *Monardella hypoleuca* each as distinct species based on discrete characters and geographical separation of each entity. However, given the apparent and limited introgression between subspecies *lanata* and subspecies *intermedia*, we think it better at this time to retain them as subspecies of one closely related, currently recognized, wide-ranging species. Subspecies *hypoleuca* may be best treated as a discrete species from subspecies *lanata* and subspecies *intermedia* based on its distinct geographic range and lack of introgression, but we are being conservative at this point.

Paratypes. U.S.A. **California:** Orange Co., *S. Boyd 8352* (RSA, SD), *P. C. Everett 7266* (RSA), *J. T. Howell 1094* (RSA), *s.n.* (IRVC 18585), *s.n.* (IRVC 18577), *s.n.* (IRVC 20008), *K. G. Marsh s.n.* (IRVC 18602), *s.n.* (IRVC 18642), *s.n.* (IRVC 25321), *P. A. Munz 7742* (GH, LA in UC, POM, UC), *J. C. Nevin s.n.* (DS 130615), *F. W. Peirson 4036* (RSA), *F. M. Roberts 1128* (IRVC), *2939* (IRVC), *3115* (IRVC), *4117* (RSA), *A. C. Sanders 407* (UCR), *31607* (IRVC, UCR), *31609* (IRVC, UCR), *31613* (CAS, IRVC, K, RSA, SD, UCR), *C. B. Wolf 8003* (DS, LA in UC, MO, NY, RSA, UC), *J. M. Wood 15* (UCR); Riverside Co., *W. P. Armstrong 1277* (RSA, SD), *E. LaRue s.n.* (UCR 57138), *J. C. Roos s.n.* (UCR 23575); San Diego Co., *D. L. Banks 1256* (RSA), *1648A* (RSA), *1805* (RSA), *2229* (RSA), *S. Boyd 8333* (RSA), *C. Lamareaux 43983* (SD), *E. E. Schellenger s.n.* (UC 56935).

1c. Monardella hypoleuca A. Gray subsp. **lanata** (Abrams) Munz, Aliso 4: 97. 1958. Basionym: *Monardella lanata* Abrams, Muhlenbergia 8: 39. 1912. TYPE: U.S.A. California: San Diego Co., Descanso Grade near the top, 19 July 1906, *K. Brandegee s.n.* (holotype, UC 104626).

Distribution. *Monardella hypoleuca* subsp. *lanata* is found in the Peninsular Ranges of southern San Diego County, California, U.S.A., and Baja California, Mexico.

2. Monardella saxicola I. M. Johnston, Bull. S. Calif. Acad. Sci. 18: 19. 1919. *Monardella hypoleuca* A. Gray var. *saxicola* (I. M. Johnston) Jepson, Man. Fl. Pl. Calif. 882. 1925. *Monardella viridis* Jepson subsp. *saxicola* (I. M. Johnston) Ewan, Bull. Torrey Bot. Club 64: 521. 1937. TYPE: U.S.A. California: San Bernardino Co., San Antonio Mtns., at start of old trail, near Brown's Flats, 5000 ft., *I. M. Johnston 2133* (holotype, DS, MO [photo of holotype]).

Discussion. *Monardella saxicola* is recognized at the species level. It was treated as a subspecies of *M. viridis* by Jokerst (1993), but for no stated reason. *Monardella saxicola* and *M. viridis* are morphologically distinct and not easily confused, even if specimens without location data are examined. The structure of the trichomes on the leaves is strikingly different. *Monardella saxicola* is very similar to *M. hypoleuca* in leaf morphology and pubescence. Johnston (1919) reached this conclusion when he described the species and placed it closest to *M. hypoleuca* based on its habit and leaf morphology. Jepson (1925) agreed with the close relationship when he placed it as a variety of *M. hypoleuca*. Both taxa occur in the Transverse Ranges, but *M. saxicola* occurs in the eastern San Gabriel Mountains while *M. hypoleuca* occurs in the Santa Monica and Santa Ynez mountains, 135 km to the west. *Monardella viridis* occurs in the Inner North Coast Ranges, ca. 600 km to the north. This large geographic separation between *M. viridis* and *M. saxicola* makes it virtually impossible for genetic material to move between them naturally.

3. Monardella villosa Bentham, Bot. Voy. Sulph. 42. 1844. TYPE: U.S.A. California: Bodegas, *Bentham s.n.* (holotype, K [digital image]).

Discussion. *Monardella villosa* is a complex species that may have numerous narrow endemics throughout its range.

3a. Monardella villosa Bentham subsp. **villosa**.

Monardella antonina Hardham, Leafl. W. Bot. 10: 241. 1966, syn. nov. TYPE: U.S.A. California: Monterey Co., 3.7 mi. NE of San Antonio School on rd. from Lockwood to San Ardo, 27 June 1964, *C. B. Hardham 12064* (holotype, CAS not seen).

Monardella benitensis Hardham, Leafl. W. Bot. 10: 239. 1966, syn. nov. *Monardella antonina* Hardham subsp. *benitensis* (Hardham) Jokerst, Phytologia 72: 9. 1992. TYPE: U.S.A. California: San Benito Co., Clear Creek in the Diablo Range, 11 July 1965, *C. B. Hardham 12672* (holotype, CAS not seen).

Monardella globosa Greene, Pittonia 5: 82. 1902, syn. nov. *Madronella globosa* (Greene) Greene, Leafl. Bot. Observ. Crit. 1: 169. 1906. *Monardella villosa* Bentham subsp. *globosa* (Greene) Jokerst, Phytologia 72: 14. 1992. TYPE: U.S.A. California: Alameda Co., Leona,

Aug. 1892, *Michener & Bioletti s.n.* (holotype, NDG 44399 [digital image]).

Distribution. *Monardella villosa* Bentham subsp. *villosa* is found in the coastal mountain ranges of central and northern California.

3b. Monardella villosa Bentham subsp. **franciscana** (Elmer) Jokerst, Phytologia 72: 14. 1992. Basionym: *Monardella franciscana* Elmer, Bot. Gaz. 41: 320. 1906. *Madronella franciscana* (Elmer) Elmer ex A. Heller, Muhlenbergia 2: 244. 1906. *Monardella villosa* Bentham var. *franciscana* (Elmer) Jepson, Man. Fl. Pl. Calif. 881. 1925. TYPE: U.S.A. California: San Mateo Co., San Pedro, July 1903, *A. D. E. Elmer 4766* (holotype, DS not seen; isotype, CAS).

Distribution. *Monardella villosa* subsp. *franciscana* is found in the coastal mountain ranges of central California.

3c. Monardella villosa Bentham subsp. **obispoensis** (Hoover) Jokerst, Phytologia 72: 14. 1992. Basionym: *Monardella villosa* Bentham var. *obispoensis* Hoover, Fl. Calif. 3: 435. 1943. TYPE: U.S.A. California: San Luis Obispo Co., near Cuesta Pass, 20 June 1908, *I. J. Condit s.n.* (holotype, JEPS [digital image]).

Discussion. *Monardella villosa* subsp. *obispoensis* is a difficult taxon to place. It is very distinct in the center of its range and can be separated from all other *Monardella* taxa by the abundance of long, branched trichomes on its stems and leaves, especially the abaxial leaf surface. However, subspecies *obispoensis* has a zone of introgression with *M. hypoleuca* subsp. *hypoleuca* in the southern portion of its range where a few *M. hypoleuca* subsp. *hypoleuca* specimens have some branched trichomes (e.g., *D. E. Diehl s.n.*, POM 70484; *H. Baer s.n.*, POM 18167). It has a larger zone of introgression in the northern portion of its range, where a number of subspecies *obispoensis* specimens have bicolored and widely triangular-ovate leaves similar to *M. villosa* subsp. *franciscana* (e.g., *A. P. Griffiths s.n.*, OBI 58449; *C. B. Hardham 10911*, SBBG). We placed these specimens in subspecies *obispoensis* based on the abundance of branched trichomes on their foliage.

III. AUSTRALAE ALLIANCE

The Australae Alliance consists of several geographically isolated taxa that may be relictual remnants on isolated mountaintops. They have morphological characters that are more similar to parapatric taxa in this alliance than to other sympatric species. The taxa in this alliance are mat-forming to rhizomatous perennials that have long trichomes (generally longer than 0.5 mm). Species in this alliance in California include *Monardella australis* Abrams, *M. beneolens* Shevock, Ertter & Jokerst, *M. cinerea* Abrams, *M. stebbinsii* Hardham & Bartel, and a new entity described below. Epling (1925) tentatively included *M. cinerea* in his Section III, Villosae, and *M. australis* in his Section IV, Odoratissimae, as a subspecies of *M. odoratissima*.

1. Monardella australis Abrams, Muhlenbergia 8: 34. 1912. TYPE: U.S.A. California: Riverside Co., open forests of Tamarack Valley, July 1901, *H. M. Hall 2486* (holotype, DS; isotypes, MO, UC not seen).

1a. Monardella australis Abrams subsp. **australis**.

Distribution. *Monardella australis* subsp. *australis* is found in the San Bernardino, San Gabriel, and San Jacinto mountains, in Riverside and San Bernardino counties, California.

1b. Monardella australis Abrams subsp. **cinerea** (Abrams) A. C. Sanders & Elvin, comb. et stat. nov. Basionym: *Monardella cinerea* Abrams, Muhlenbergia 8: 33. 1912. TYPE: U.S.A. California: Los Angeles Co., Mt. San Antonio (Mt. Baldy), 9000 ft. or more, 24 July 1901, *L. R. Abrams 1928* (holotype, DS, MO [photo of holotype]).

Discussion. *Monardella australis* subsp. *cinerea* is reduced to a subspecies of *M. australis* based on introgressed and/or hybrid specimens in the San Gabriel, San Bernardino, and San Jacinto mountains (which is outside the traditional range of *M. cinerea*). Plants in the San Gabriel Mountains range from classic *M. cinerea* to classic *M. australis* with a continuous gradient of specimens in between. Additionally, plants approaching (if not indistinguishable from) *M. cinerea* outside of the traditional range of this species have been collected in the San Bernardino (*Elvin 3591*, IRVC, UCR; *E. C. Van Dyke s.n.*, CAS 157273) and San Jacinto mountains (*R. Hoffmann s.n.*, SBBG 72009; *C. M. Wilder 1*, UC).

1c. Monardella australis Abrams subsp. **jokerstii** Elvin & A. C. Sanders, subsp. nov. TYPE: U.S.A. California: San Bernardino Co., S face of Cucamonga Peak, just W of Day Creek, 25

Aug. 2006, *M. A. Elvin & K. VinZant 5085* (holotype, UCSB; isotypes, ARIZ, BRY, CAS, CHSC, F, GH, IRVC, JEPS, K, MO, NY, OBI, RSA, SBBG, SD, UCR, US). Figure 4.

Haec subspecies a *Monardella australi* Abrams subsp. *australi* foliis serratis et caule ramoso, a *M. australi* subsp. *cinerea* (Abrams) A. C. Sanders & Elvin foliis longioribus et habitu altiore erectoque differt.

Perennial, tufted to matted, rhizomatous, 15–35 cm tall, sparsely long-spreading and short-glandular pubescent. Leaves 14–30 × 4–8 mm on fertile stems, lanceolate, denticulate to serrate, sparsely long pubescent. Inflorescence an open compound cyme; glomerules one to several per main stem, 8–23 mm wide, often subtended by unmodified leaves; bracts 7–9 × 2–4 mm, narrowly lanceolate to lanceolate, membranaceous, generally inconspicuous in color and size. Calyx 6–8 mm, short-glandular pubescent, lobes long and acute to acuminate; corolla 10–11 mm, white to cream with purple markings appearing pale lavender, stamens exserted.

Distribution, ecology, and phenology. *Monardella australis* subsp. *jokerstii* is a rare and localized species. It occurs in the southeastern San Gabriel Mountains, in the vicinity of Cucamonga Peak (Mount San Antonio) and the western portion of Lytle Creek. It was collected once in a wash along the Santa Ana River, in the area currently occupied by the Prado Flood Control Basin, presumably washed down from the mountains above. It can appear to be locally common due to its matted, rhizomatous nature. It grows on talus slopes between breccia, ranging in size from 10–40 cm wide, and on secondary alluvial benches along drainages and washes. It occurs at elevations between 1350 and 1750 m with the Santa Ana River collection an exception at 160 m. It flowers from July through September.

Etymology. The specific epithet refers to James Jokerst, who identified the uniqueness of specimens of this entity by annotation of one of them in 1993 (*I. M. Johnston 5118*, GH), in honor of his work on this genus prior to his untimely death in 1995.

Related taxa. This plant is closely related to both *Monardella australis* subsp. *australis* and *M. australis* subsp. *cinerea*. It differs from subspecies *australis* in having prominent serrations on the leaves, up to 2 mm, and in having branched stems with multiple glomerules in a compound cyme. It differs from *M. australis* subsp. *cinerea* in having longer leaves (to 30 mm vs. to 10 mm) and a taller, erect habit (to 35 cm vs. to 15 cm).

Paratypes. U.S.A. **California:** San Bernardino Co., *L. Benson 15036* (POM), *I. M. Johnston 5118* (DS, GH, NY, US), *D. Swinney 1932* (RSA, UCR), 12 July 1968, *L. C. Wheeler s.n.* (CAS 972052, NY, RSA 638951, UCR 113687).

IV. ODORATISSIMAE ALLIANCE

The Odoratissimae Alliance consists of plants that range from suffrutescent perennials to shrubs with erect, woody stems. The plants in this alliance are generally glabrous to pubescent (with trichomes up to 0.5 mm) and have similar pubescence on both sides of the leaves. The taxa in this alliance occur in many plant communities throughout the western United States from Colorado to Washington, south through Oregon and California, U.S.A., to Baja California, Mexico. Species in this alliance that occur in California include *Monardella follettii* (Jepson) Jokerst, *M. linoides* A. Gray (including five subspecies), *M. odoratissima* (only two subspecies occur in California), *M. palmeri* A. Gray, *M. purpurea* Howell, *M. robisonii* Epling, *M. stoneana* Elvin & A. C. Sanders, *M. viminea* Greene, and three new taxa from the Mojave Desert that warrant recognition, but for which appropriate relationships and ranks are unresolved. Therefore, we tentatively describe each of these three below as species, with the understanding that they may eventually only warrant recognition as subspecies. Epling (1925) grouped *M. odoratissima* and *M. linoides* together in Section IV, Odoratissimae, in his monograph. We are also including *M. robisonii* in the Odoratissimae Alliance based on similarities of its habit and herbage to both *M. odoratissima* and *M. linoides*. *Monardella robisonii* was not described until after Epling wrote his monograph, so its placement was not discussed. We are also including *M. palmeri* in this alliance based on its glabrous pubescence and apparent close relationship to *M. purpurea*, which Epling included as a synonym of *M. odoratissima* in his monograph.

1. **Monardella boydii** A. C. Sanders & Elvin, sp. nov. TYPE: U.S.A. California: San Bernardino Co., Ord Mtns., Ord Mtn., Willow Spring Canyon, 5000 ft., 6 Oct. 2007, *M. A. Elvin with A. C. Sanders 5811* (holotype, RSA; isotypes, BRY, IRVC, JEPS, MO, UCR, UCSB). Figure 5.

Haec species *Monardellae linoidi* A. Gray similis, sed ab ea inflorescentia ramosa, glomerulis minoribus, bracteis brevioribus (< 10 mm) angustioribus (< 4 mm) et calyce breviore differt.

Subshrub to shrub, 12–40 cm tall, erect; stems visibly woody at base, multi-branched from middle to apex, pubescence fine and dense (mostly 0.03–0.05 mm long), but not completely obscuring epidermis, lacking conoideus glands on stems, aromatic. Leaves 7–15 × 1–3(–5) mm, narrowly

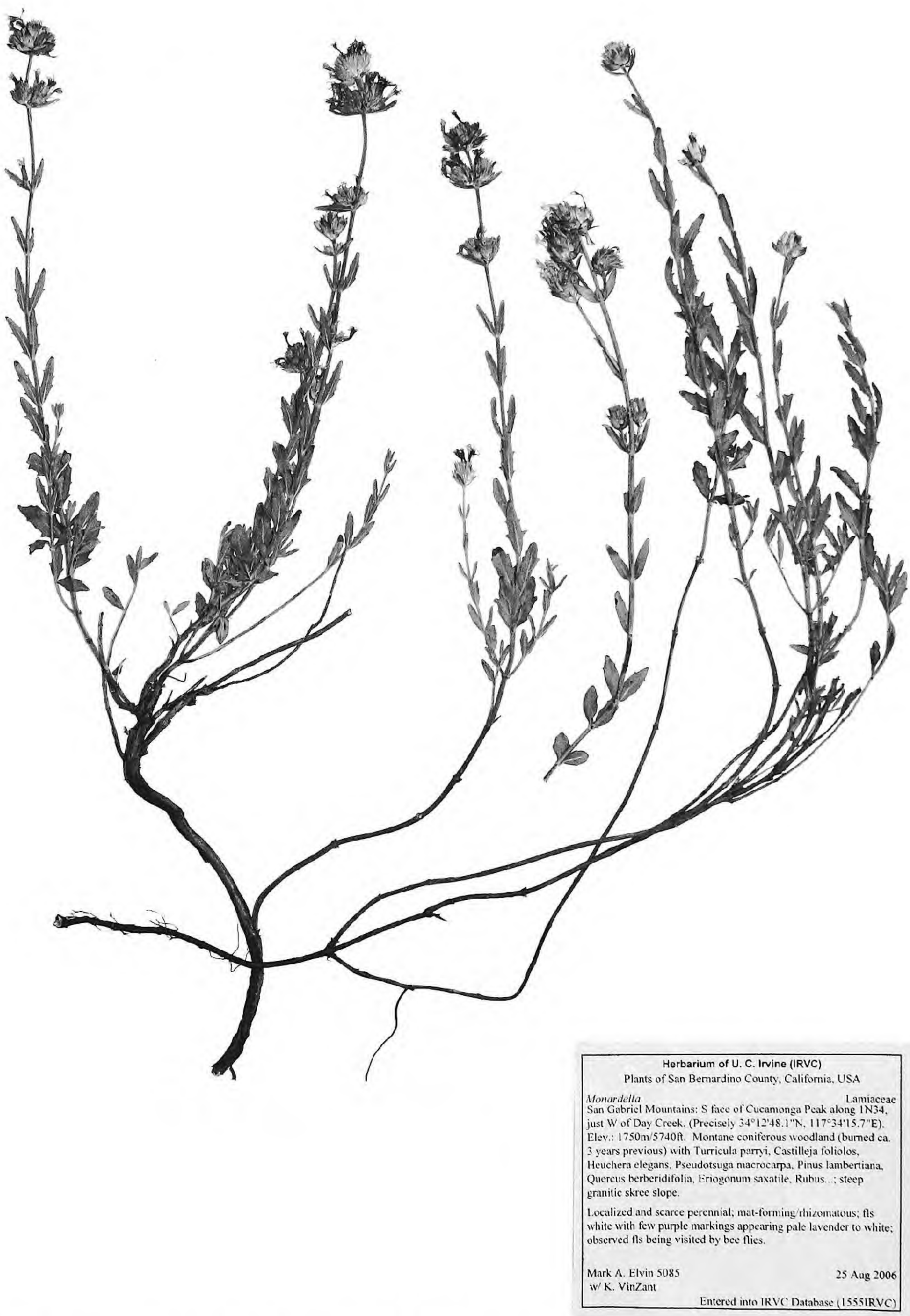

Figure 4. *Monardella australis* subsp. *jokerstii* Elvin & A. C. Sanders (holotype, *M. A. Elvin & K. VinZant 5085*, UCSB). Image by David Pereksta.

elliptic, acute, gray-green or silvery green. Inflorescence an open cyme, (1)3 to 5 glomerules per main stem, 10–20 mm wide; bracts 8–9 × 2–3 mm, less than or equal to calyces, narrowly elliptic, inconspicuous, deciduous, green to purple tinged, acuminate. Calyx 6–8 mm, lobes acute, pubescent, with abundant, spreading, nonglandular trichomes 0.2–0.3 mm long, sparsely and minutely puberulent with

Figure 5. *Monardella boydii* A. C. Sanders & Elvin (holotype, *M. A. Elvin with A. C. Sanders 5811*, RSA). Image by David Pereksta.

gland-tipped trichomes 0.01–0.02 mm long. Corolla 10–11 mm, white with purple markings, appearing lavender, pubescent, tube slightly exserted beyond calyx.

Distribution, ecology, and phenology. *Monardella boydii* is a rare plant known only from the Ord and Rodman mountains in the southern Mojave Desert. It grows in mixed desert scrub, desert riparian scrub,

and juniper woodland habitats. It has been documented at elevations between 1400 and 1650 m, primarily in alluvial soils and cracks of bedrock in washes on canyon bottoms and rocky slopes. It flowers from August to October.

Etymology. The specific epithet refers to Steve Boyd of Rancho Santa Ana Botanic Garden Herbarium, who in 1988 led the expedition that first collected this plant in the Ord Mountains of the southern Mojave Desert, far from any other known *Monardella* populations. This species also commemorates Steve's contributions, dedication, and driving curiosity to understand and explain the unique flora of southern California.

Related taxa. Monardella boydii is a difficult taxon to place. It is similar to, and apparently closely related to, several taxa that occur in the desert, specifically, *M. robisonii*, *M. arizonica* Epling, *M. linoides* s.l., and two other new taxa that occur in the Mojave Desert. It has a series of differences (sometimes small, but still discrete) from these other taxa. Cladograms analyzing morphological characters indicate that its relationship to these other taxa is unresolved. We are provisionally describing *M. boydii* here as a species because of this lack of resolution in relation to other taxa, and this placement is likely to minimize the necessary taxonomic revisions once more information is obtained (i.e., genetic data). Because of this apparent close relationship with *M. robisonii*, *M. arizonica*, *M. linoides* s.l., and two other new taxa, *M. boydii* may be best recognized as a subtaxon of one of them.

Monardella boydii is similar to *M. linoides* s.l. in its habit and the presence of a short, dense, uniform pubescence. Its pubescence is similar to that of *M. linoides*, even more so than that of *M. viminea*, which has been placed as a subspecies of *M. linoides* in various publications (Epling, 1925; Munz, 1974; Jokerst, 1993). Individual trichomes are distinguishable at 10× and, while the pubescence is dense, it does not completely cover the epidermis (as in *M. linoides*), resulting in the stems appearing greenish with the naked eye. Even with magnification of just 10×, the epidermis can easily be observed. It is distinguished from *M. linoides* by its branching inflorescence, smaller glomerules (10–20 mm vs. 10–30 mm wide), smaller, narrower bracts (2–3 mm vs. 5–14 mm wide), shorter calyx (6–8 mm vs. 8–9 mm), and its distinct and separate geographic distribution.

Monardella boydii is similar to *M. robisonii* in its habit, leaf morphology, narrow bracts, and the presence of small glomerules and branching inflorescences. It is distinguished from *M. robisonii* in that the calyces contain minute, glandular trichomes (0.01–0.02 mm) and the stem contains minute trichomes (0.03–0.05 mm) and lacks the longer, spreading trichomes (0.1–0.2 mm and 0.3–0.5 mm) and short glandular trichomes (0.01–0.03 mm) of *M. robisonii*.

Monardella boydii is also very similar to two other taxa that occur in mountains of the Mojave Desert (described below) in general habit, bract morphology, and floral morphology (e.g., inflorescence branching pattern, glomerule size). *Monardella boydii* differs from these taxa in leaf, bract, and pubescence characters and they each have distinct, non-overlapping geographic ranges. These similarities and differences are discussed below.

Paratypes. U.S.A. **California:** San Bernardino Co., *S. Boyd 1704* (RSA), *M. A. Elvin 5776* (GH, IRVC, K), *5779* (IRVC, OBI, SBBG, UCSB), *5801* (IRVC, SD), *5802* (IRVC, MO), *5803* (BRY, IRVC), *5804* (IRVC, JEPS), *5805* (CHSC, IRVC), *5806* (IRVC, UCR), *5807* (IRVC, UCR), *5808a, b, c* (IRVC), *5809* (IRVC, RSA), *5810* (IRVC, US), *5822* (ARIZ, CAS, IRVC, NY), *6181* (UCSB), *6183* (UCSB), *6184* (UCSB), *6185* (UCSB), *6186* (GH, LA, UCSB), *6187* (UCSB), *6188* (RSA, UCSB), *6189* (BRY, GMDRC, UCSB), *6190* (UCR, UCSB), *6193* (CAS, SD, UCSB), *A. C. Sanders 34399* (UCR), *34403* (UCR), *34404* (UCR), *34405* (UCR).

2. Monardella eremicola A. C. Sanders & Elvin, sp. nov. TYPE: U.S.A. California: San Bernardino Co., Clark Mtn., Fir Canyon, 5600 ft., 13 Aug. 2001, *A. C. Sanders & M. A. Elvin 24570* (holotype, UCR; isotypes, IRVC, RSA). Figure 6.

Haec species quoad habitum, inflorescentiam ramosum, glomerulos parvos et bracteas angustas *Monardellae robisonii* Epling et *M. arizonicae* Epling similis, sed ab eis caulibus glandibus conoideis praeditis, trichomatibus glandularibus patentibus carentibus et calyce breviore differt.

Subshrub to shrub, 15–55 cm tall, erect, camphor-like aroma; stems visibly woody at base, pubescence fine and dense (with some trichomes 0.03–0.08 mm long, and some longer, spreading trichomes approximately 0.2–0.3 mm), but not completely obscuring the epidermis, numerous stout, conoideus glands. Leaves 12–27 × 3–10 mm, narrowly elliptic, acute to obtuse, subsessile, pale or grayish green. Inflorescence an open compound cyme; glomerules solitary on secondary stems, 7–20 mm wide; bracts 4.5–9 × 2–4.5 mm (ca. equal to the calyces), narrowly elliptic to narrowly lanceolate, acute. Calyx 5–7 mm, pubescence nonglandular; corolla 8–11 mm, white with purple markings, appearing lavender.

Distribution, ecology, and phenology. Monardella eremicola is a rare plant of the desert mountains in the northeastern Mojave Desert. It apparently has a limited distribution, having only been documented

Figure 6. *Monardella eremicola* A. C. Sanders & Elvin (holotype, *A. C. Sanders & M. A. Elvin 24570*, UCR).

from the Clark and Kingston mountains of California. *Monardella eremicola* occurs well above the desert floor at elevations between 1500 and 2100 m. It grows in rock outcrops, among boulders, in boulder cracks, on rocky canyon slopes, and on the margins of desert washes. It is associated with granite or limestone soils in desert riparian scrub and pinyon-juniper woodland and is particularly common in bedrock cracks and on benches along canyon washes. It flowers from June to August.

Etymology. The specific epithet refers to the fact that all known collections of this plant have been made in the desert.

Related taxa. *Monardella eremicola* is a difficult taxon to place. It is similar to, and apparently closely related to, several taxa that occur in the desert, specifically, *M. robisonii*, *M. arizonica*, *M. linoides* s.l., *M. boydii*, and one other new taxon that occurs in the Mojave Desert. It has a series of differences (sometimes small, but still discrete) from these other taxa. Cladograms analyzing morphological characters indicate that its relationship to these other taxa is unresolved, perhaps due to reticulation. We are provisionally describing *M. eremicola* here as a species because of this lack of resolution in relation to other taxa, and this placement is likely to minimize the necessary taxonomic revisions once more information is obtained (i.e., genetic data). Because *M. eremicola* appears to be closely related to *M. robisonii*, *M. arizonica*, *M. linoides* s.l., *M. boydii*, and one other new taxon, it may best be treated as a subtaxon of one of them. Numerous introgressant specimens occur between *M. eremicola*, a new subspecies of *M. linoides* (described below), and *M. odoratissima* subsp. *glauca* (Greene) Epling in the mountain ranges of the northern Mojave Desert, particularly in the Panamint and Amargosa mountain ranges of Inyo County. One specimen from the Kingston Mountains (*R. F. Thorne 54796*, RSA) contains few conoideus glands, but matches the rest of the plants from this area in all other characters, and we are tentatively including it here as *M. eremicola*. A specimen from northwest Arizona (*G. L. Clifton 39183*) is intermediate between *M. arizonica* and *M. eremicola* in that it contains some characters from both *M. eremicola* and *M. arizonica* that the other does not possess (e.g., nonglandular trichomes on the calyx; minute, glandular trichomes on the stem; long, spreading trichomes [0.25–0.5 mm] on the stem).

Monardella eremicola is similar to *M. linoides* s.l. in its habit, lack of glandular pubescence on the stems and calyces, and leaf length and morphology. It is distinguished from *M. linoides* by its branching inflorescence; smaller glomerules (7–20 mm vs. 10–30 mm wide); smaller, narrower bracts (2–4.5 mm vs. 5–14 mm wide); shorter calyx (5–7 mm vs. 8–9 mm); sparser, longer pubescence; abundance of conoideus glands on the stem; and its distinct and separate geographic distribution. The stem epidermis of *M. eremicola* is more visible than in *M. linoides* because of this sparser pubescence. Individual trichomes are distinguishable at 10× and, while the pubescence is dense, it does not completely cover the epidermis (as in *M. linoides*), resulting in the stems appearing

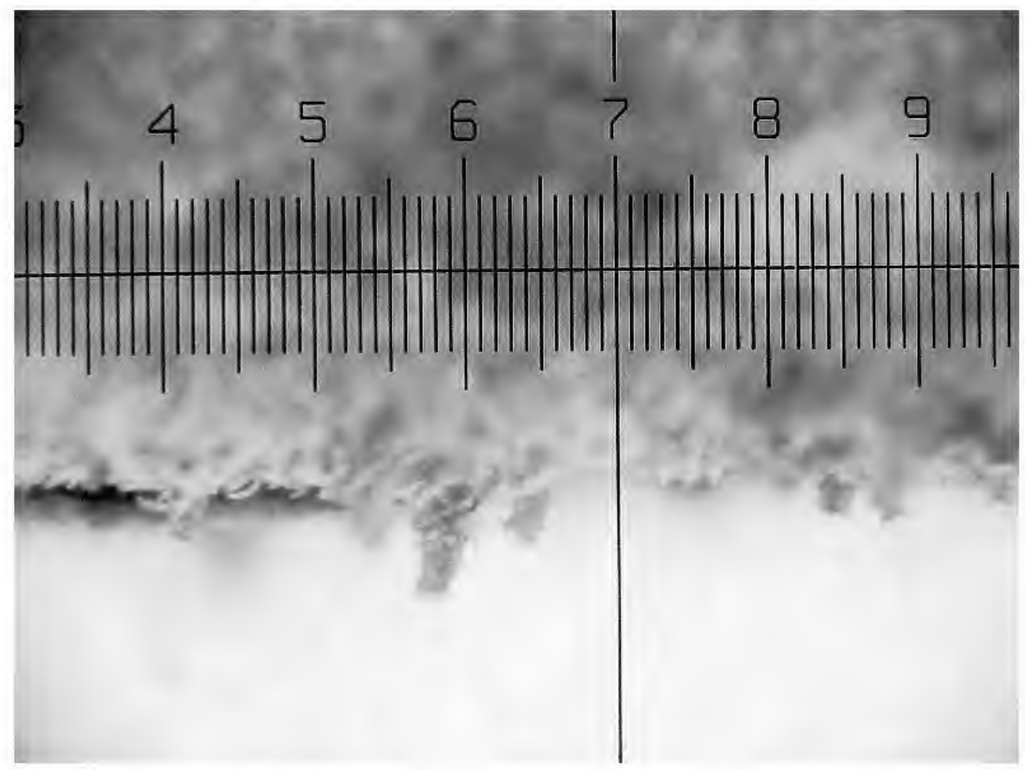

Figure 7. *Monardella eremicola* A. C. Sanders & Elvin. Conoideus gland. Each unit on the scale equals 0.5 mm. Image by David Pereksta.

greenish with the naked eye. Even with magnification of just 10×, the epidermis can easily be observed. The conoideus glands are miniature, stout protuberances that are subcylindrical to conical in shape and resemble miniature volcanoes (Fig. 7). They are an extension of the epidermis and occasionally have a pubescence similar to that on the adjacent stem. These structures were noticed by Johnston (1919), who called them stalked glands, and by Hardham (in unpublished notes and specimen annotations), who called them hydathodes. Some taxa always have them (e.g., *M. lanceolata* A. Gray var. *glandulifera* I. M. Johnston, *M. eremicola*), but most taxa do not have them.

Monardella eremicola is similar to *M. robisonii* and *M. arizonica* in its habit, narrow bracts, small glomerules, branching inflorescences, and presence of longer, spreading trichomes (ca. 0.25 mm) on the stem. It shares with *M. robisonii* the presence of longer spreading trichomes (0.2–0.3 mm) and lack of glandular pubescence on the calyx. It is similar to *M. arizonica* in leaf length and width. It is distinguished from *M. robisonii* and *M. arizonica* by the presence of conoideus glands on the stems, the absence of spreading, glandular trichomes on the stems, shorter calyces (5–7 mm vs. 6–9 mm and 5–9 mm, respectively), and its distinct and separate geographic distribution.

Monardella eremicola is similar to both *M. boydii* and another taxon from the mountains of the central Mojave Desert (described below) in general habit, pubescence, bract morphology, leaf morphology, and floral morphology (e.g., inflorescence branching pattern, glomerule size). *Monardella eremicola* differs from *M. boydii* in that it contains conoideus glands on the stem; it lacks minute, glandular trichomes on the calyx; it contains longer, spreading trichomes >

0.1 mm on the stem; it has leaves that are > 15 mm long and > 5 mm wide; and its geographic distribution is distinct and separate. It differs from the new Mojave Desert taxon in that it contains conoideus glands on the stem; it lacks minute, glandular trichomes on the calyx; it contains long (0.2–0.3 mm), spreading, nonglandular trichomes on the calyx; the bracts are shorter (4.5–9 mm vs. 10–11 mm); and its geographic distribution is distinct and separate.

Paratypes. U.S.A. **California:** San Bernardino Co., *G. de Nevers 445* (CAS), *268* (CAS, RSA), *J. Hendrickson 14057* (NY, SD), *E. C. Jaeger s.n.* (POM 187366), *s.n.* (POM 179282), *B. A. Prigge 1327* (RSA), *2186* (CAS, RSA), *2198* (RSA, UCR), *1975* (UCR), *J. C. Roos 4642* (RSA, UCR), *A. C. Sanders 24565* (IRVC, UCR), *24566* (UCR), *24567* (UCR), *24568* (UCR), *24569* (UCR), *24571* (UCR), *C. B. Wolf 7577* (DS, RSA, UCR), *7650* (RSA).

3. Monardella linoides A. Gray, Proc. Amer. Acad. Arts 11: 101. 1876. TYPE: U.S.A. California: San Diego Co., mtns. E of San Diego, Oriflame Mine, southern part of San Diego Co., 28 July 1875, *D. E. Palmer 296* (holotype, GH; isotypes, MO [annotation by C. Epling: "Gray Herbarium sheet is unnumbered. U. of Calif. sheet is numbered and dated as this is. Two sheets at U.S. Herb. are numbered '261' with no month or day noted. This does compare to Palmer notes."], NY [2], UC, US [2]).

Discussion. *Monardella linoides* s.l. (including all subtaxa) only seems to hybridize with other *Monardella* species in three portions of its extensive range: the eastern San Bernardino Mountains, the mountains of the northern Mojave Desert (e.g., the Panamint, White, and Inyo mountains), and the southern Sierra Nevada Mountains region. Notably, *M. linoides* seems not to form hybrids anywhere in the Peninsular Ranges, not even in the San Jacinto Mountains, where *M. linoides* subsp. *linoides* is sympatric with *M. australis* (a species that it putatively hybridizes with in the San Bernardino Mountains).

3a. Monardella linoides A. Gray subsp. **linoides.**

Distribution. The range of *Monardella linoides* subsp. *linoides* encompasses the Peninsular Ranges in Riverside and San Diego counties, California, U.S.A., and Baja California, Mexico. We tentatively include plants from the Little San Bernardino Mountains (of the Transverse Ranges) that are, for the most part, consistent with *M. linoides* subsp. *linoides*. Specimens from the Morongo Valley and Pioneertown areas of the Little San Bernardino Mountains (at the eastern edge of the San Bernardino Mountains) correspond best with subspecies *linoides*; however, there are slight but consistent differences between the plants in the Little San Bernardino Mountains and those in the Peninsular Ranges. Beyond the plants in the Little San Bernardino Mountains, subspecies *linoides* does not occur north of the Transverse Ranges (i.e., Mojave Desert, Sierra Nevada Mountains), despite numerous, previous reports and determinations (Epling, 1925; Jepson, 1943; Munz, 1974; Jokerst, 1993).

3b. Monardella linoides A. Gray subsp. **anemonoides** (Greene) Elvin & A. C. Sanders, stat. nov. Basionym: *Monardella anemonoides* Greene, Pittonia 5: 86. 1902. *Madronella anemonoides* (Greene) Greene, Leafl. Bot. Observ. Crit. 1: 169. 1906. *Monardella linoides* A. Gray var. *anemonoides* (Greene) Jepson, Man. Fl. Pl. Calif. 882. 1925. TYPE: U.S.A. California: Kern Co., Greenhorn Mtns., 6000–7000 ft., 7–15 June 1888, *E. Palmer 69* (holotype, US; isotypes, MO, NY).

Distribution and ecology. *Monardella linoides* subsp. *anemonoides* is recognized as a subspecies of *M. linoides*. It is a rather local endemic of the southwestern Sierra Nevada Mountains in Kern and Tulare counties. It is closely allied to both *M. linoides* subsp. *oblonga* (Greene) Abrams and an unnamed *M. linoides* subspecies from the eastern Sierra Nevada Mountains that is described below. The tall, thick stems (to 60 cm, 1–1.5 mm thick just below glomerule) and very large bracts (15–25 × 10–14 mm) of subspecies *anemonoides* are quite distinct and make it rather easy to recognize. A few specimens at the southern edge of its range in the Tehachapi Mountains (Kern Co., *Dudley 429* [DS], *Dudley 476* [DS, NY, US]) appear to be intermediate between subspecies *anemonoides* and subspecies *oblonga*.

3c. Monardella linoides A. Gray subsp. **erecta** (Abrams) Elvin & A. C. Sanders, comb. et stat. nov. Basionym: *Monardella epilobioides* Greene var. *erecta* Abrams, Muhlenbergia 8: 36. 1912. TYPE: U.S.A. California: San Bernardino Co., on dry ridges, Bear Valley, 3 Aug. 1902, *L. Abrams 2861* (holotype, DS; isotypes, GH, MO, UC [2], US).

Distribution and ecology. *Monardella linoides* subsp. *erecta* is endemic to the eastern San Bernardino Mountains of San Bernardino County, California. The *Monardella* populations in the San Bernardino Mountains are confusing, with many of the plants

containing characters from both *M. australis* s.l. and *M. linoides* s.l. It appears likely that these two generally distinct species hybridize here and have formed a large zone of introgression, perhaps because of the distinctive topography of this area. There is no similar geographical feature in other mountain ranges where these two species come into contact. *Monardella linoides* subsp. *erecta* represents one end of the spectrum of these plants with regard to habit, pubescence, and leaf and bract morphology, while *M. australis* subsp. *australis* represents the opposite extreme. *Monardella linoides* subsp. *erecta* is an erect, caespitose plant, 15–30 cm tall, with a short, dense, and uniform pubescence that obscures the epidermis. It has broadly linear to narrowly lanceolate leaves with entire margins, and the narrowly lanceolate bracts are roughly equal to the calyces. *Monardella australis* subsp. *australis* is a mat-forming, rhizomatous plant, 10–20 cm tall, with rather long and variable pubescence, lanceolate to narrowly ovate leaves that are entire to weakly serrate, and lanceolate to long acuminate bracts that exceed the calyces.

The type specimens for *Monardella linoides* var. *stricta* Parish (San Bernardino Co., *S. B. Parish 2077* [holotype, UC; isotype, DS]) and *M. epilobioides* (San Bernardino Co., *S. B. Parish 3008* [holotype, US; isotypes, MO, UC]) represent introgressant individuals that are intermediate in characters between *M. linoides* subsp. *erecta* and *M. australis* subsp. *australis*. It is also possible that there may be several recognizable entities in the San Bernardino Mountains that are closely related to both *M. linoides* subsp. *erecta* and *M. australis* subsp. *australis*. It has been observed by one of the authors that there appear to be correlations or groupings of character suites to specific microhabitats and general geographic ranges in this area that may represent local differentiation and incipient speciation associated with localized substrates. We cannot separate these entities at this time and more study is needed.

3d. Monardella linoides A. Gray subsp. **oblonga** (Greene) Abrams, Ill. Fl. Pacific States 3: 655. 1951. Basionym: *Monardella oblonga* Greene, Pittonia 5: 83. 1902. *Monardella linoides* A. Gray var. *oblonga* (Greene) Munz, Man. S. Calif. Bot. 450. 1935. TYPE: U.S.A. California: Kern Co., in the mtns. S of Tehachapi, 24 June 1889, *E. L. Greene s.n.* (holotype, NDG 44420 [digital image]; isotype, UC 292735, MO 905498 [photo of UC sheet]).

Distribution. *Monardella linoides* subsp. *oblonga* is found in the Tehachapi Mountains of Kern County and the Mount Pinos region of Ventura and Kern counties, California.

3e. Monardella linoides A. Gray subsp. **sierrae** Elvin & A. C. Sanders, subsp. nov. TYPE: U.S.A. California: Inyo Co., desert slopes near Big Pine Creek at foot of trail to Big Pine Lakes, 8500 ft., 24 July 1934, *R. S. Ferris 8983* (holotype, UC; isotypes, DS, NY). Figure 8.

Haec subspecies quoad habitum, pubescentiam, foliorum formam et glomerulos solitarios *Monardellae linoidi* subsp. *anemonoidi* (Greene) Elvin & A. C. Sanders et subsp. *oblongae* (Greene) Abrams similis, sed a hac caulibus altioribus et bracteis latioribus, ab illa bracteis minoribus, pedunculo breviore et glomerulis minoribus differt.

Subshrub to shrub, 20–50 cm tall, erect, visibly woody at base, densely pubescent. Leaves 20–30 × 4–10 mm, length to width ratio 3–5:1, lanceolate to broadly (ob)lanceolate, pale green, petioles 2–4 mm, base acute, subglabrous to sparsely puberulent adaxially and sparsely puberulent abaxially (especially on the veins). Inflorescence solitary, peduncles slender (< 1 mm thick just below glomerule), generally 1–7 cm long (from highest definite leaf to glomerule); glomerule 15–25 mm wide; bracts 11–16 × 5–9 mm, broadly lanceolate to narrowly ovate, attenuate, greater than or equal to the calyces. Corolla pale to rose.

Distribution, ecology, and phenology. *Monardella linoides* subsp. *sierrae* is the predominant form of *M. linoides* northwest of the Mojave Desert. It is commonly collected in the Sierra Nevada Mountains at elevations of 1000–3500 m along the ridge and eastern slope, from Kern, through Tulare, Inyo, Fresno, Madera, and Mono counties in California and Washoe and Esmeralda counties in Nevada. It occurs mostly on open, gravelly to rocky slopes with granitic soils in montane coniferous forest, pinyon-juniper woodland, and chaparral. Subspecies *sierrae* is similar to subspecies *anemonoides* and subspecies *oblonga* in habit, pubescence, its solitary glomerules, and leaf morphology. It is distinguished from subspecies *anemonoides* by its smaller bracts (11–16 × 5–9 mm vs. 15–25 × 10–14 mm), shorter peduncles (1–7 cm vs. 5–15 cm), and smaller glomerules (15–25 mm vs. 20–30 mm wide). It is distinguished from subspecies *oblonga* by its taller stems (20–50 cm vs. 15–25 cm) and wider bracts (5–9 mm vs. 4–7 mm). It flowers June through September. Leroy Abrams noted the distinctiveness of this entity in an annotation on an *H. M. Hall 8380* collection (UC).

Etymology. The specific epithet refers to the Sierra Nevada Mountains, where this plant occurs.

Figure 8. *Monardella linoides* subsp. *sierrae* Elvin & A. C. Sanders (holotype, *R. S. Ferris 8983*, UC).

Related taxa. *Monardella linoides* subsp. *sierrae* appears to have one zone of limited hybridization and two extensive zones of introgression. It hybridizes with *M. odoratissima* on the Kern Plateau in the southern Sierra Nevada Mountains, where scattered intermediate specimens have been found. It intergrades with multiple *Monardella* taxa in two areas, one in the southern Sierra Nevada Mountains extending down into the Tehachapi Mountains of Kern and Ventura counties and one in the desert mountains at the

southern end of Death Valley. Introgressant specimens between *M. linoides* subsp. *sierrae* and both subspecies *anemonoides* and subspecies *oblonga* occur from the southern Sierra Nevada Mountains south and west into the Tehachapi Mountains. Some of the specimens from this area clearly represent typical material of subspecies *oblonga* and some represent typical material of subspecies *sierrae*. Numerous introgressant specimens between *M. linoides* subsp. *sierrae*, *M. odoratissima*, and *M. eremicola* occur in the mountain ranges of the northern Mojave Desert, particularly in the Panamint and Amargosa mountain ranges of Inyo County. Many of the specimens from this area display a blend of characters intermediate between these three taxa, but do not fit well into any one of them.

Paratypes. U.S.A. **California:** Fresno Co., *F. J. Smiley 646* (GH); Inyo Co., *R. Bacigalupi 6067* (UC), *E. K. Balls 18030* (RSA), *K. Brandegee s.n.* (UC 185726), *D. Charlton 1990* (RSA, SD), *S. F. Cook s.n.* (UC 1282601), *A. Davidson 2751* (RSA), *M. DeDecker 45* (RSA), *2153* (RSA [2]), *2334* (RSA), *2755* (CAS, RSA, UCR), *3872* (RSA), *6231* (RSA [2]), *R. S. Ferris 1381* (CAS), *M. F. Gilman 1847* (US), *G. K. Helmkamp 2445* (UCR), *4282* (UCR), *R. Hoffmann s.n.* (SBBG 71940), *s.n.* (SBBG 71945), *J. W. Hopkins s.n.* (SBBG 71939), *D. F. Howe 3053* (SD), *J. T. Howell 24150* (CAS, RSA, UCR), *25390* (CAS), *26692* (CAS), *40221* (CAS, NY), *E. C. Jaeger s.n.* (RSA 50668), *s.n.* (POM 246676), *D. D. Keck 534* (POM, UC), *M. Kerr s.n.* (SBBG 72005), *F. Klyver s.n.* (DS 171012), *W. Knight 4314* (CAS), *R. M. Lloyd 2670* (UC), *2741* (UC), *K. Morris 468* (NY), *P. A. Munz 16537* (GH, POM, UC, US), *F. W. Peirson 1068* (RSA), *7543* (RSA, SD), *C. A. Purpus 5089* (GH, UC), *P. H. Raven 183* (CAS, UC), *9675* (CAS), *J. C. Roos 2836* (DS), *L. Rowntree s.n.* (CAS 299289), *D. W. Taylor 7251* (JEPS), *8220* (CAS), *R. F. Thorne 38816* (RSA), *C. B. Wolf 3252* (CAS, GH, RSA); Kern Co., *D. E. Breedlove 3843* (CAS, DS, MO), *C. A. Purpus 5096* (GH, MO, UC, US), *E. C. Twisselmann 3061* (CAS [2]), *13726* (CAS), *R. Twitchell s.n.* (RSA 518326); Madera Co., *O. H. Kappler 1911* (LA in UC); Mono Co., *M. S. Baker 9088* (CAS), *R. C. Barneby 5843* (NY), *J. D. Cassel 247* (DS), *P. C. Everett 21967* (NY, SD), *G. K. Helmkamp 5940* (UCR), *J. T. Howell 14264* (LA in UC), *M. E. Jones s.n.* (CAS 154856, DS 171312, POM 145491, SBBG 71941), *D. D. Keck 3882* (DS [2], UC), *A. Mardyke s.n.* (JEPS 63348), *J. D. Morefield 3768* (MO, NY, RSA, UC), *A. Noldeke s.n.* (CAS 299264), *F. W. Peirson 1065* (RSA), *6033* (RSA), *10727* (RSA, UC), 28 July 1933, *F. W. Peirson s.n.* (RSA), *P. H. Raven 9934* (CAS), *J. C. Roos s.n.* (RSA 658653), *L. S. Rose 35349* (CAS, LA in UC), *L. Rowntree s.n.* (CAS 299290), *D. W. Taylor 16877* (JEPS); Tulare Co., *C. Bornstein 00-077* (SBBG), *S. Boyd 1918* (RSA, UCR), *S. Boyd 10561* (RSA), *B. Ertter 6330* (NY), *H. M. Hall 5268* (DS), *5415* (DS), *8380* (UC), *C. B. Hardham 12235* (CAS, GH), *K. Harper s.n.* (UCR 46141), *J. T. Howell 42808* (CAS), *43094* (CAS, NY), *48585* (CAS), *J. Keefe 13164* (CAS), *N. Meng 433* (SBBG), *P. A. Munz 15241* (RSA), *D. Myrick 1197* (CAS, SBBG), *J. R. Shevock 781* (CAS), *E. C. Twisselmann 7837* (CAS), *12651* (SBBG), *14401* (CAS), *18450* (CAS, RSA); Ventura Co., *R. Burgess 7644* (IRVC, SBBG). **Nevada:** Washoe Co., *P. B. Kennedy 1925* (CAS); Esmeralda Co., *R. S. Ferris 6745* (DS).

4. **Monardella mojavensis** Elvin & A. C. Sanders, sp. nov. TYPE: U.S.A. California: San Bernardino Co., Mojave Desert, Granite Mtns., above Snake Spring, 4400 ft., 10 Sep. 2008, *M. A. Elvin & T. La Doux 6161* (holotype, UCSB; isotypes, JEPS, MO, RSA, UCR). Figure 9.

Haec species *Monardellae linoidi* A. Gray similis, sed ab ea caulis trichomatibus sparsioribus, inflorescentia ramosa, calyce breviore trichomatibus glandularibus vestito et bracteis angustioribus calycem superantibus differt.

Subshrub to shrub, 30–60 cm tall, erect; stems visibly woody at base, multi-branched from middle to apex, pubescence fine, dense, and short (ca. 0.03 mm), partially obscuring epidermis, aromatic. Leaves 8–20 × 2–4 mm, narrowly elliptic, acute, gray-green or silvery. Inflorescence an open compound cyme with 3 to 7 glomerules per stem; glomerules 10–20 mm wide; bracts 10–11 × 2–5 mm, longer than calyces. Calyx 5–7 mm, lobes acute, puberulent and with spreading gland-tipped hairs; bracts becoming pale and scarious inward, the outermost often green and leaf-like, narrowly ovate with acuminate tips. Corolla 10–11 mm, white with purple markings, appearing lavender, pubescent, tube exserted from calyx.

Distribution, ecology, and phenology. *Monardella mojavensis* is presently known from five mountain islands in the arid ranges of the eastern Mojave Desert in California (Old Woman, Granite, Old Dad, and Providence mountains) and southwestern Nevada (Newberry Mountains). It may be more widely distributed in California and southern Nevada and could also occur in northwestern Arizona. It grows in mixed desert scrub, pinyon-juniper woodland, and desert riparian scrub habitats. It has been documented at elevations between 800 and 1500 m. It grows among granite boulders and on decomposed granite soils but has also been collected on limestone soils. Microhabitats include flats, boulder fields, washes, crevices among boulders, and cliffs. Leroy Abrams noted the distinctiveness of this entity in an annotation on a *K. Brandegee s.n.* collection (UC 104649). It flowers from May to August.

Etymology. The specific epithet refers to the Mojave Desert in the western United States, where all known collections have been made.

Related taxa. *Monardella mojavensis* is a difficult taxon to place. It is similar to, and apparently closely related to, several taxa that occur in the desert, specifically, *M. robisonii*, *M. arizonica*, *M. linoides* s.l., *M. boydii*, and *M. eremicola*. It has a series of differences (sometimes small, but still discrete) from these other taxa. Cladograms analyzing morphological

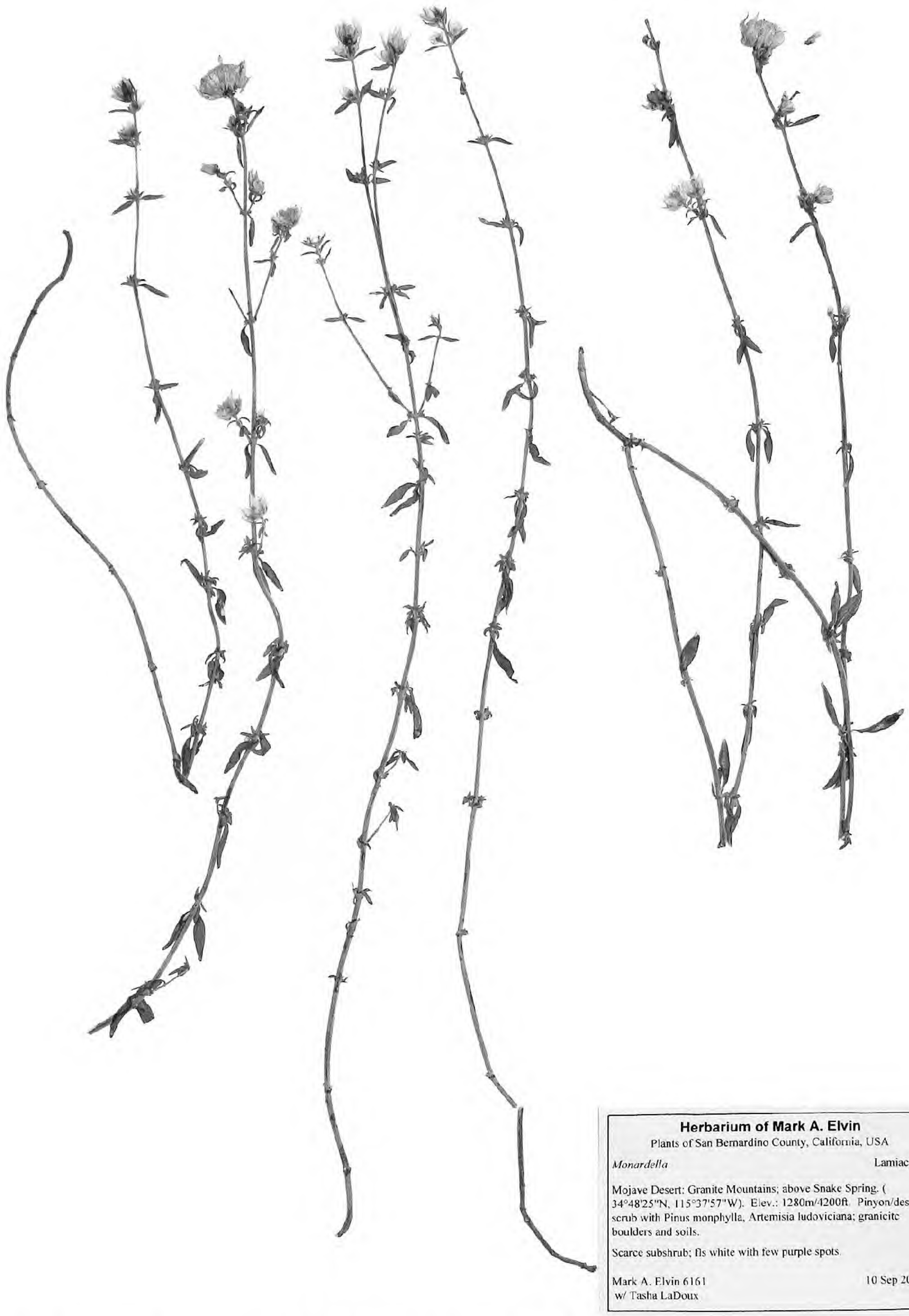

Figure 9. *Monardella mojavensis* Elvin & A. C. Sanders (holotype, *M. A. Elvin & T. La Doux 6161*, UCSB). Image by David Pereksta.

characters indicate that its relationship to these taxa is unresolved. We are provisionally describing *M. mojavensis* here as a species because of this lack of resolution in relation to other taxa, and this placement is likely to minimize the necessary taxonomic revisions once more information is obtained (i.e., genetic data). Because *M. mojavensis* appears to be closely related to *M. robisonii*, *M. arizonica*, *M. linoides* s.l., *M. boydii*, and *M. eremicola*, it may best be treated as a subtaxon of one of them.

Monardella mojavensis is similar to *M. linoides* s.l. in its habit, leaf width, and the presence of a short, dense, uniform pubescence. Individual trichomes are distinguishable at 10× and, while the pubescence is dense, it is less dense than that of *M. linoides* and does not completely cover the epidermis (as in *M. linoides*), resulting in the stems appearing greenish with the naked eye. Even with magnification of just 10×, the epidermis can easily be observed. It is distinguished from *M. linoides* by its branching inflorescence; smaller glomerules (10–20 mm vs. 10–30 mm wide); smaller, narrower bracts (2–5 mm vs. 5–14 mm wide); shorter calyces (5–7 mm vs. 8–9 mm); the presence of glandular trichomes on the calyces; and its distinct and separate geographic distribution.

Monardella mojavensis is similar to *M. robisonii* in habit, leaf morphology, bract length and width, and the presence of small glomerules and branching inflorescences. It is distinguished from *M. robisonii* in that the calyx contains minute, glandular trichomes (0.01–0.02 mm) and spreading, glandular trichomes (0.06–0.1 mm); the stem contains minute trichomes (0.03–0.05 mm) and lacks the longer, spreading trichomes (0.1–0.2 mm and 0.3–0.5 mm) and short glandular trichomes (0.01–0.03 mm) of *M. robisonii*; its shorter calyces (5–7 mm vs. 6–9 mm); and its distinct and separate geographic distribution.

Monardella mojavensis is also very similar to *M. boydii* and *M. eremicola* in general habit, bract morphology, and floral morphology (e.g., inflorescence branching pattern, glomerule size). *Monardella mojavensis* differs from *M. boydii* in bract length (10–11 mm vs. 8–9 mm); it lacks spreading, glandular trichomes and contains spreading nonglandular trichomes (0.2–0.3 mm) on the calyces; and it has a distinct and separate geographic range. *Monardella mojavensis* differs from *M. eremicola* in that it lacks conoideus glands on the stem; lacks longer spreading trichomes (> 0.1 mm) on the stem; the leaves are shorter and narrower; the bracts are longer (10–11 mm vs. 4.5–9 mm); it contains glandular trichomes on the calyces; and its geographic distribution is distinct and separate.

Paratypes. U.S.A. **California:** San Bernardino Co., *B. Baldwin 273* (RSA), *Mrs. K. Barnes s.n.* (LA 62688 in UC), *D. Bradbury 277* (RSA [2]), *K. Brandegee s.n.* (UC 104649), *J. Donahue 76214* (RSA), *M. A. Elvin 6151* (JEPS, UCSB), *6152* (UCR, UCSB), *6153* (UCSB), *6154* (UCSB), *6155* (UCSB), *6156* (GMDRC, JEPS, RSA, UCSB), *6157* (BRY, UCSB), *6158* (SD, UCSB), *6159* (GH, OBI, UCSB), *6160* (CAS, LA, UCSB, US), *6162* (NY, SBBG, UCSB), *E. C. Jaeger s.n.* (POM 254461), *M. E. Jones 25505* (POM), *J. R. Haller 1329* (UCSB), *s.n.* (UCSB 10511), *J. Hendrickson 12734* (RSA), *12747a* (NY), *18834* (RSA), *P. A. Munz 4234* (POM), *B. Pitzer 4013* (UCR), *D. Silverman 7* (SD, UCR), *B. A. Stein 43* (RSA [2]), *R. F. Thorne 50689* (RSA). **Nevada:** Clark Co., *J. S. Holland 1440* (UCR, UNLV not seen), *G. E. Marrs-Smith BLM 30* (UCR, UNLV not seen).

5. Monardella odoratissima Bentham, Labiat. Gen. Spec. 332. 1834. TYPE: U.S.A. Washington: Columbia River and White Mtns., *Douglas s.n.* (holotype, K [digital image]).

5a. Monardella odoratissima Bentham subsp. **odoratissima**.

Distribution. *Monardella odoratissima* subsp. *odoratissima* occurs in southern Washington and northern Oregon. This subspecies does not occur in California. No material that has been collected in California conforms to material from the type locality.

5b. Monardella odoratissima Bentham subsp. **glauca** (Greene) Epling, Ann. Missouri Bot. Gard. 12: 62. 1925. Basionym: *Monardella glauca* Greene, Pittonia 4: 321. 1901. *Madronella glauca* (Greene) Greene, Leafl. Bot. Observ. Crit. 1: 169. 1906. *Monardella odoratissima* Bentham var. *glauca* (Greene) H. St. John, Res. Stud. State Coll. Wash. 1: 64. 1929. TYPE: U.S.A. Oregon: eastern Oregon, 21 June 1898, *Cusick 1956* (holotype, US not seen; isotypes, GH not seen, MO not seen).

Discussion. *Monardella odoratissima* subsp. *glauca* is recognized as a subspecies of *M. odoratissima*. It was treated as a full species by Jokerst (1993), but for no stated reason. Subspecies *glauca* plants are highly variable, and there is a large zone of introgression between subspecies *glauca* and *M. pallida* A. Heller along the crest of the Sierra Nevada Mountains. Plants in California attributed to *M. odoratissima* subsp. *parvifolia* (Greene) Epling are misapplied to that name and are part of the above-mentioned hybrid swarm.

5c. Monardella odoratissima Bentham subsp. **pallida** (A. Heller) Epling, Ann. Missouri Bot. Gard. 12: 66. 1925. Basionym: *Monardella pallida* A. Heller, Muhlenbergia 1: 36. 1904. *Madronella pallida* (A. Heller) A. Heller, Muhlenbergia 1: 138. 1906. TYPE: U.S.A. California: Nevada Co., ridge near lower end of Donner Lake (S side), 17 July 1903, *A. A. Heller 6959* (holotype, MO not seen; isotypes, DS not seen, GH not seen, UC not seen, US not seen).

Discussion. *Monardella odoratissima* subsp. *pallida* is recognized as a subspecies of *M. odoratissima*. It was treated as a full species by Jokerst (1993), but

for no stated reason. There is a vast zone of introgression with subspecies *glauca* along the crest of the Sierra Nevada Mountains. Subspecies *pallida* generally has leaves that closely subtend the glomerules, but are not modified. Some call these leaves bracts. They are generally green, but some plants have slightly modified leaves in this position and when these are purplish some suspect hybridization with subspecies *glauca*.

6. Monardella robisonii Epling, Man. S. Calif. Bot. 451, 600. 1935. TYPE: U.S.A. California: Riverside Co., Keys Ranch, Little San Bernardino Mtns., among boulders and crevices, 20 Apr. 1934, *C. Epling s.n.* (holotype, LA 62494 in UC).

Discussion. *Monardella robisonii* has been thought to be closely related to *M. linoides* based on similarity in habit and leaf morphology (Epling, 1939), and one of the authors has expressed doubts about their separation. These species have been separated largely on the basis of differences in their pubescence (Epling, 1935, 1939; Abrams, 1951; Munz, 1974; Jokerst, 1993), which is long, spreading, and variable in length and direction on *M. robisonii* in contrast to the short, appressed, and uniform pubescence of all subspecies of *M. linoides*. *Monardella robisonii* is best distinguished by its long, spreading trichomes (0.3–0.5 mm long), branching inflorescence, narrow bracts, and glandular trichomes on the stem. It occurs in the San Bernardino Mountains at the southern edge of the Mojave Desert. *Monardella robisonii* differs from *M. linoides* in that it has (1) minute, glandular trichomes (0.01–0.03 mm) under the rather long, spreading pubescence on the stems; (2) small bracts (9–12 × 3–5 mm) that are generally equal to the calyces; (3) leaves that are generally wider than the linear to narrowly lanceolate leaves of *M. linoides*; (4) smaller glomerules (7–20[–25] mm wide); and (5) multi-branching inflorescences; but it lacks the short, dense, uniform pubescence that obscures the epidermis of *M. linoides*.

V. ANNUAE ALLIANCE

The Annuae Alliance consists of erect, annual plants that occur throughout California including coastal, montane, and desert habitats. Plants in this alliance occur throughout California and into southwestern Nevada, U.S.A., and northern Baja California, Mexico. The plants of this alliance can be distinguished by their stature (herbaceous stems), annual growth form, lanceolate foliage, and pubescence. Much of the variation in these plants occurs in characters associated with the flowers (i.e., bracts, calyces). Several species in this alliance are narrow endemics (two of which are considered extinct, neither having been seen since 1941), but a few are quite wide-ranging with one species occurring from northern California, U.S.A., to Baja California, Mexico. Species in this alliance in California include *Monardella breweri* A. Gray, *M. candicans* Bentham, *M. douglasii* Bentham (including two subspecies), *M. exilis* (A. Gray) Greene, *M. lanceolata* (including three varieties), *M. leucocephala*, *M. pringlei* A. Gray, and a new taxon described below (including two subspecies).

1. Monardella breweri A. Gray, Proc. Amer. Acad. Arts 7: 386. 1867. TYPE: U.S.A. California: Contra Costa Co., Corral Hollow, E side of north Coast Range, E of Mt. Diablo, 3 June 1862, *Brewer 1213* (holotype, GH; isotypes, UC not seen, US not seen).

Discussion. *Monardella breweri* occurs throughout California's Coast, Transverse, Sierra Nevada, and Peninsular ranges. We recognize this species as comprising four subspecies, including *M. lanceolata* and its sometimes recognized varieties *M. lanceolata* var. *glandulifera* and *M. lanceolata* var. *microcephala* A. Gray.

1a. Monardella breweri A. Gray subsp. **breweri.**

Distribution and ecology. *Monardella breweri* subsp. *breweri* occurs primarily in the South Coast Range from Ventura County northward to Alameda County, but extends southeast into the Tehachapi, San Gabriel, and western San Bernardino mountains. The type was collected from the northernmost station for this species.

1b. Monardella breweri A. Gray subsp. **glandulifera** (I. M. Johnston) Elvin, comb. et stat. nov. Basionym: *Monardella lanceolata* A. Gray var. *glandulifera* I. M. Johnston, Bull. S. Calif. Acad. Sci. 18: 20. 1919. TYPE: U.S.A. California: Los Angeles Co., Brown's Flat, San Gabriel Mtns., 4300 ft., 1 Sep. 1918, *I. M. Johnston 2139* (holotype, POM not seen; isotypes, DS, UC).

Discussion. *Monardella breweri* subsp. *glandulifera* is recognized as a subspecies of *M. breweri*. It was described as a variety of *M. lanceolata* (Johnston, 1919), separated based on the abundance of conoideus glands on the stem and other characters (e.g., pubescent calyx sinuses). It was recognized as a variant of *M. lanceolata* by Munz (1974) and then synonomized with *M. lanceolata* by Jokerst (1993) as "generally indistinct."

Distribution and ecology. Monardella breweri subsp. *glandulifera* is a local endemic of the southern San Gabriel Mountains in Los Angeles County, California. While it does occur within the range of *M. lanceolata*, it differs from it in its smaller stature, smaller glomerules, and the abundance and density of conoideus glands on the stem. Conoideus glands occur on some *M. lanceolata* specimens, but are found only in very low densities. *Monardella lanceolata* specimens that have conoideus glands are sparsely distributed across the southern slopes of the Transverse Ranges. This may indicate that reproductive isolating mechanisms have not fully developed between *M. breweri* subsp. *glandulifera* and *M. lanceolata*. *Monardella breweri* subsp. *glandulifera* is similar to *M. lanceolata* var. *microcephala* in its stature, small glomerules, and the size of its bracts. It differs from it in that its stems are covered with an abundance of conical glands, the sinuses of the calyx are pubescent, and it has a distinct geographic range in the San Gabriel Mountains, ca. 195 km northwest of the Jacumba Mountains, where *M. lanceolata* var. *microcephala* reaches its northern limit.

1c. Monardella breweri A. Gray subsp. **lanceolata** (A. Gray) A. C. Sanders & Elvin, comb. et stat. nov. Basionym: *Monardella lanceolata* A. Gray, Proc. Amer. Acad. Arts 11: 102. 1876. *Madronella lanceolata* (A. Gray) Greene, Leafl. Bot. Observ. Crit. 1: 169. 1906. TYPE: U.S.A. California: Mariposa Co., Yosemite Valley, July 1866, *H. N. Bolander 6320* (lectotype, designated here, GH; duplicate, US not seen).

Monardella sanguinea Greene, Pittonia 5: 86. 1902. *Madronella sanguinea* (Greene) Greene, Leafl. Bot. Observ. Crit. 1: 169. 1906. *Monardella lanceolata* A. Gray var. *sanguinea* (Greene) Jepson, Man. Fl. Pl. Calif. 883. 1925. TYPE: [U.S.A.] California: San Diego Co., 1881, *G. W. Dunn s.n.* (lectotype, designated here, NDG 44439 [digital image]).

Distribution and ecology. Monardella breweri subsp. *lanceolata* occurs in the Sierra Nevada Mountains (in California and Nevada), the Cascade Ranges (and adjacent Klamath Range), the Transverse Ranges (San Bernardino, San Gabriel, and Tehachapi mountains), and the Peninsular Ranges, as well as in coastal valleys and plains of southern California.

Related taxa. Monardella breweri subsp. *lanceolata* is very similar to subspecies *breweri*. They share habit, leaf morphology and size, stem and leaf pubescence, and floral morphology including glands on the tips of the uppermost two petals. They are often difficult to separate because they overlap and intergrade for some 240 km between the San Bernardino and Santa Ynez mountains in the Transverse Ranges. The distinction between these species blurs and disappears in this vast region where the reproductive isolating mechanisms between these two species appear to be weak at best. Many collections in this zone of introgression possess characters of both taxa. The two subspecies differ mainly in bract shape and venation. The bracts of subspecies *lanceolata* are lanceolate-ovate or narrower, have acute (but not acuminate) tips, are weakly to strongly cross veined, and may or may not be tinted purple.

No type specimen has been published for *Monardella lanceolata*, and Gray (1876) did not cite any specimens in his description of the species. He simply listed the range for the plant as "California, from Plumas to San Diego Co.," which suggests he had seen a number of specimens from scattered localities. A specimen at NY, *Palmer 294* (NY, MO not seen), is listed on the NY website as "Type," but with no supporting reference. Abrams (1912b) listed *Palmer 294* as a paratype under his circumscription of *M. lanceolata* var. *microcephala*. We reviewed specimens that were likely to have been seen by Gray or that were in the Gray Herbarium at the time he described *M. lanceolata* (including *Palmer 294*). Based on the information available in the literature (including the description for *M. lanceolata*), we selected *H. N. Bolander 6320* as the most representative specimen and hereby designate it as the lectotype.

Greene wrote "Type!" on two of the three specimens that he mentioned in the *Monardella sanguinea* protologue, but he did not explicitly designate one specimen as type. We reviewed digital images of these specimens; the first specimen that Greene mentions in his description (*G. W. Dunn s.n.*, NDG 44439) is the most representative and we therefore designate it as lectotype here.

1d. Monardella breweri A. Gray subsp. **microcephala** (A. Gray) Elvin & A. C. Sanders, comb. et stat. nov. Basionym: *Monardella lanceolata* A. Gray var. *microcephala* A. Gray, Syn. Fl. N. Amer. (ed. 2) 2(1): 459. 1886. TYPE: U.S.A. California: San Diego Co., Potrero, 24 July 1883, *Orcutt 928* (holotype, MO not seen; isotypes, GH [2]).

Monardella peninsularis Greene, Pittonia 5: 87. 1902. *Madronella peninsularis* (Greene) Greene, Leafl. Bot. Observ. Crit. 1: 169. 1906. TYPE: Mexico. Baja California: "from some uncertain station in the northern part of the peninsula of Lower California," 6 June 1885, *C. R. Orcutt s.n.* (holotype, NDG 44430 [digital image]).

Distribution and ecology. *Monardella breweri* subsp. *microcephala* is similar to subspecies *lanceolata*, to which it has generally been allied. Munz (1959) mentions it as a minor variant under *M. lanceolata*; Jokerst (1993) thought that named "forms" [subtaxa] of *M. lanceolata* were indistinct, but did not formally address *M. breweri* subsp. *microcephala*; Wiggins (1980) treated it as a variety of *M. lanceolata* and considered it to be the only taxon of *M. lanceolata* present in Baja California, Mexico. It is predominantly a plant of northern Baja California, Mexico, but extends into southern San Diego County, California, U.S.A., where the type was collected. This plant is apparently rare north of Mexico.

Related taxa. *Monardella breweri* subsp. *microcephala* is characterized by very small glomerules (7–15 mm broad, rarely to 20 mm), a highly branched habit with short internodes, and glomerules in a ± cymose arrangement. Both subspecies *breweri* and subspecies *lanceolata* have larger glomerules that tend to be solitary at the ends of the relatively few and long inflorescence branches. Subspecies *microcephala* plants are generally short (9–30 cm), as compared to 15–65 cm for subspecies *breweri* and *lanceolata*, even when they are well developed. It has a conspicuously short and bushy habit compared to subspecies *breweri* and *lanceolata*. The bracts of subspecies *microcephala* seem to nearly always lack purple pigments, as do many subspecies *lanceolata* specimens, unlike bracts of subspecies *breweri*, which are almost always purple tinted. Perhaps the most notable characters of subspecies *microcephala* are that its bracts are extremely short (5–7 mm), no longer than the calyces that they subtend, and generally lanceolate-ovate. Conversely, the bracts of subspecies *lanceolata* are longer (10–15 mm), extend beyond the calyces that they subtend, and broader. Even diminutive plants of subspecies *lanceolata* have bracts that are at least 10 mm long and exceed the calyces. *Monardella breweri* subsp. *microcephala* rarely has leaves that subtend the glomerules, and if it does they tend to be short. Conversely, subspecies *breweri* and subspecies *lanceolata* often have long leaves immediately subtending the glomerule that extend beyond it. Subspecies *microcephala* has five to six bracts per glomerule, whereas subspecies *breweri* and subspecies *lanceolata* generally have eight to 10 bracts per glomerule. Subspecies *microcephala* calyces are short (ca. 6–7 mm), but are only slightly shorter than subspecies *breweri* and *lanceolata*, whose calyces are ca. 6.5–7.5 mm. The low number of flowers per glomerule (three to 25) appears to be the major factor governing glomerule size and the main defining character for this taxon. As is expected with subspecies, there is a large zone of introgression with numerous intermediate specimens between subspecies *microcephala* and *lanceolata*. Abrams (1912b) noted an abundance of specimens in southern California (specifically in central San Diego County) that demonstrate a clear gradient between subspecies *microcephala* and subspecies *lanceolata*.

2. Monardella douglasii Bentham, Labiat. Gen. Spec. 332. 1834. *Madronella douglasii* (Bentham) Greene, Leafl. Bot. Observ. Crit. 1: 168. 1906. TYPE: U.S.A. California: northern California, s.d., *Douglas s.n.* (holotype, K [digital image]; isotype, K [digital image]).

Distribution. *Monardella douglasii* occurs in the foothills of the coastal mountain ranges adjacent to and south of San Francisco Bay.

3. Monardella sinuata Elvin & A. C. Sanders, sp. nov. TYPE: U.S.A. California: Santa Barbara Co., Burton Mesa, W of Santa Lucia Canyon, N of Lakes Canyon, 15 May 2006, *M. A. Elvin, L. Lum & L. Ballard 4904* (holotype, UCSB; isotypes, IRVC, JEPS, MO, RSA, UCR, US). Figure 10.

Haec species a *Monardella breweri* A. Gray foliis margine undulato et bracteis anguste ovatis scariosis vel viridibus differt.

Annual, erect, gracile, 8–65 cm tall, simple or sparsely to moderately branched, sparsely pubescent, stems straw to tan. Leaves 10–55 × 3–8 mm, in axillary clusters, linear to oblanceolate, ± fleshy, subglabrous to sparsely pubescent, margins weakly to strongly wavy. Inflorescence open compound cyme; glomerules 10–25 mm wide; bracts 7–12 × 3–9 mm, elliptic to narrowly ovate, tips obtuse to acute, but not attenuate, scarious to green, purple-tinged or not. Calyx lobes acute, densely pubescent, tube less pubescent than lobes; corolla 14–20 mm, upper 2 lobes gland-tipped, lavender to purple.

Etymology. The specific epithet refers to the sinuous leaf edges.

Related taxa. *Monardella sinuata* is an annual plant with undulate leaf margins that occurs along the central coast of California. It has long been mistakenly called *M. undulata*, but as noted above, the type specimen and description of *M. undulata* are of a perennial plant. The annual with undulate leaf margins has not been described to date, even though it is well known to California botanists.

The exact relationship of *Monardella sinuata* to other similar *Monardella* species is not obvious. Epling (1925) placed *M. undulata* in the annual

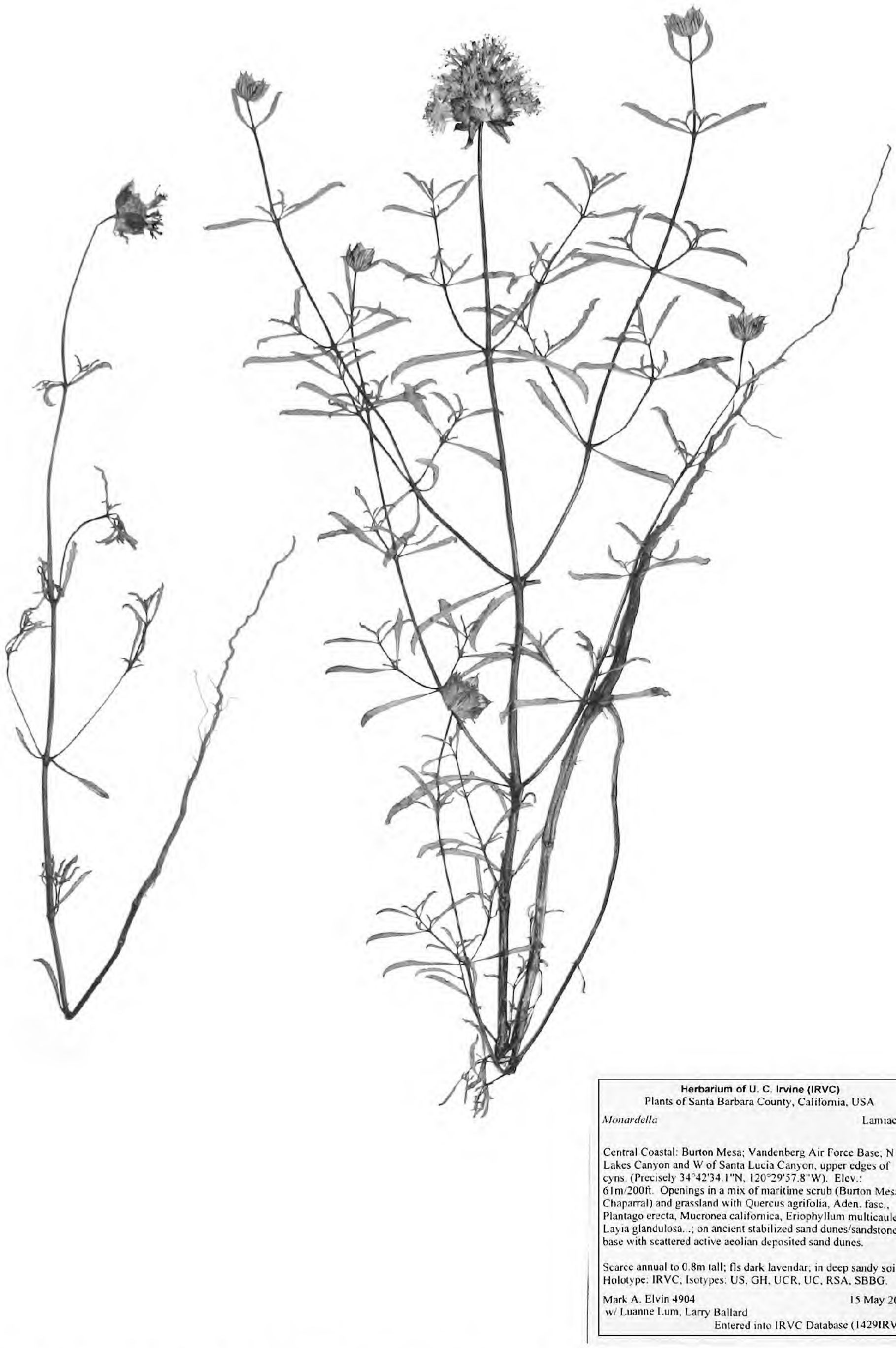

Figure 10. *Monardella sinuata* Elvin & A. C. Sanders subsp. *sinuata* (holotype, *M. A. Elvin et al. 4904*, UCSB). Image by David Pereksta.

section, Section II, Annuae, even though under his concept *M. undulata* included perennials and subshrubs as well. *Monardella sinuata* has clear affinities with the other undulate-leaved *Monardella* taxa with which it has typically been associated. However, overall, it is more similar and appears to be more closely allied with *M. breweri*, *M. douglasii*, and other annual *Monardella* species, based on its leaf and

bract morphology, pubescence, stature (herbaceous stems), the presence of glands on the tips of the upper petals, and especially its annual habit. *Monardella sinuata* primarily differs from the other annual *Monardella* species in its possession of undulate leaf margins. Based on these characteristics, we are including it in the annual species alliance.

Paratypes. U.S.A. **California:** San Luis Obispo Co., *B. Anderson 173* (OBI), *A. Eastwood 14954* (CAS), *C. Epling s.n.* (IRVC 4605), *A. P. Griffiths s.n.* (OBI 58373), *s.n.* (OBI 58377), *s.n.* (OBI 58392, UCR 115289), *s.n.* (OBI 58393), *s.n.* (OBI 58394), *s.n.* (OBI 58395), *C. B. Hardham 7047* (SBBG), *12070* (SBBG), *G. K. Helmkamp 5676* (UCR), *s.n.* (UCR 13783), *R. F. Hoover 7304* (CAS [2], DS, OBI [2]), *9033* (CAS, OBI), *D. F. Howe 3568* (SD), *M. P. Ingalls s.n.* (CAS 25461), *J. D. Jokerst 2902* (CHSC), *D. Keil 16322* (OBI, SBBG), *B. Miossi 141* (OBI), *R. J. Rodin 6080* (OBI), *F. Rush s.n.* (OBI 13617), *M. E. Schneider s.n.* (OBI 26262), *R. W. Summers 656* (CAS [2]), *E. C. Twisselmann 2428* (CAS [2]); Santa Barbara Co., *L. E. Allen s.n.* (SBBG 45184), *s.n.* (SBBG 45719), *E. R. Blakley 3487* (SBBG), *D. E. Breedlove 4140* (CAS, DS), *J. Broughton 1191* (SBBG), *P. Burns 100* (UCSB), *E. R. Chandler 3746* (OBI, SBBG), *E. Collins 31* (UCSB), *K. C. Danielsen 7* (UCSB), *55* (UCSB), *L. W. Edge 189* (SBBG), *s.n.* (SBBG 53007), *W. R. Ferren LP-107* (UCSB), *LP-426a* (UCSB), *H. C. Forbes LP-122* (IRVC, UCSB), *A. P. Griffiths s.n.* (OBI 58369), *J. R. Haller 1714* (UCSB), *D. Hickson 16* (UCSB), *R. Hoffmann s.n.* (SBBG 6420), *s.n.* (SBBG 72003), *D. F. Howe 3562* (SD), *D. Keil 24596* (OBI), *25350* (OBI), *H. L. Mason 408* (DS), *H. E. McMinn 1041* (DS), *M. Olson 225* (UCSB), *B. Orr LP-92* (UCSB), *H. M. Pollard s.n.* (SBBG 41747), *P. H. Raven 15513* (DS), *L. Roundtree s.n.* (CAS 299291), *C. F. Smith 6286* (SBBG), *8018* (SBBG), *9957* (SBBG), *A. Whistler 1A* (UCR, UCSB); Ventura Co., *N. French 311* (UC), *D. Howe 4924* (SD); county not listed, St. Simeón, s.d., *Gambel s.n.* (GH), s.d., *E. Palmer 362* (GH).

3a. Monardella sinuata Elvin & A. C. Sanders subsp. **sinuata**.

Distribution and ecology. Monardella sinuata subsp. *sinuata* occurs in coastal areas from Morro Bay in San Luis Obispo County south to Surf in Santa Barbara County with historical collections in Ventura County, California; however, it has not been collected or reported from Ventura County since 1976, and there is little suitable habitat remaining where it formerly occurred (M. A. Elvin & R. Burgess, pers. obs.). *Monardella sinuata* is restricted to sandy soils in coastal strand, dune scrub, openings in sagebrush scrub, coastal chaparral, and coastal oak woodlands from sea level to approximately 300 m. It flowers from April through September. It is rather uncommon overall, but can be locally common.

There is an undated collection by Gambel (*Gambel s.n.*, GH), with the label as "St. Simeón" (presumably San Simeon, San Luis Obispo County), that may be from north of the otherwise known range of subspecies *sinuata*. This collection is intermediate between subspecies *sinuata* and another, more northerly, subspecies (described below) in bract characters. Some other subspecies *sinuata* plants from the Morro Bay area also tend toward some aspects of the northern subspecies in that they exhibit some darkening of the tips of the calyces, slightly darkened bract veins, and a more compact habit relative to the plants from Santa Barbara County. However, they still fit better within subspecies *sinuata* and we include them there.

3b. Monardella sinuata Elvin & A. C. Sanders subsp. **nigrescens** Elvin & A. C. Sanders, subsp. nov. TYPE: U.S.A. California: Marin Co., Point Reyes Peninsula, 12.5 mi. from Inverness, sandy knoll on crest of ridge, 18 May 1938, *A. Carter 1417* (holotype, GH; isotypes, DS, RSA not seen, UCR). Figure 11.

Haec subspecies a *Monardella sinuata* Elvin & A. C. Sanders subsp. *sinuata* caule robusto fuscato et bracteis latioribus brevioribus apice nigrescentibus venis furvis differt.

Annual, erect, stout, 8–45 cm tall, branched throughout to simple, sparsely pubescent, stems dark. Leaves 10–30 × 4–10 mm, in axillary clusters, lanceolate to narrowly oblanceolate, ± fleshy, margins weakly wavy. Inflorescence cyme or compact cyme; glomerules 10–35 mm wide; bracts 9–16 × 6–12 mm, elliptic to ovate, obtuse to acute, but not attenuate, scarious to green, purple-tinged or not, tips dark (black), veins dark (black) and spreading hairy. Calyx pubescent, lobes dark-tipped and acute; corolla 14–20 mm, upper 2 petals gland-tipped, lavender to purple.

Distribution, ecology, and phenology. Monardella sinuata subsp. *nigrescens* ranges from just south of Monterey Bay in Monterey County, north to Point Reyes in Marin County, California. It is restricted to sandy soils in dunes, dune scrub, and openings in coastal scrub with occurrences documented in Marin, San Francisco, Santa Cruz, Contra Costa, Santa Clara, San Mateo, and Monterey counties, California. It grows from sea level to approximately 300 m elevation and flowers from May through July. It is apparently very uncommon.

Etymology. The subspecific epithet refers to the black (dark) tips on the calyces and bracts and the dark bract veins.

Discussion. Monardella sinuata plants in the northern part of the species range differ from those in the southern portion, and are here recognized as a distinct subspecies. The bract tips and veins are noticeably dark brown to black. The glomerules are larger (10–35 mm vs. 10–25 mm wide for subsp.

Figure 11. *Monardella sinuata* subsp. *nigrescens* Elvin & A. C. Sanders (holotype, *A. Carter 1417*, GH).

sinuata) and the bracts are wider, shorter, and darker. The stems are stout, robust, and dark.

Paratypes. U.S.A. **California:** Marin Co., *A. Eastwood 4773* (CAS, GH), *18858* (CAS), 5 May 1901, *A. Eastwood s.n.* (GH), *A. D. E. Elmer s.n.* (CAS 25467, DS 64344), *C. B. Hardham 10447* (CAS), *A. A. Heller 15732* (DS), *D. F. Howe 4251* (SD), *s.n.* (SD 88517), *J. T. Howell 53725* (CAS), *G. T. Robbins 3895* (CAS, OBI), *G. B. Rosshach 778* (DS), *C. B. Wolf 5776* (GH); Monterey Co., *E. Cannon s.n.* (CAS 25462), *P. F. Covel 1478* (CAS, SBBG), *L. E. Cox s.n.* (DS 23588), *W.*

R. Dudley s.n. (DS 23587), *A. Eastwood 6041* (CAS), *A. D. E. Elmer 4379* (CAS), *L. A. Greata 615* (DS), *A. A. Heller 8426* (DS, GH), *R. F. Hoover 9113* (CAS, OBI), *J. Jokerst s.n.* (CHSC 67992), *V. Keresztury s.n.* (CHSC 67993), *E. A. Purer 3838* (SD), *3861* (SD), *F. G. Woodcock s.n.* (CAS 299262); San Francisco Co., *A. Eastwood s.n.* (CAS 25463), *J. T. Howell 11431* (CAS, GH), *W. N. Suksdorf 786* (GH); Santa Cruz Co., *W. R. Dudley s.n.* (DS 572519, DS 63417), *R. S. Ferris 11138* (DS, GH), *V. F. Hesse 981* (CAS), *J. H. Thomas 6016* (DS, SD); s. loc., *H. N. Bolander 69* (GH), *Hartweg 1912* (GH).

4. **Monardella venosa** (Torrey) A. C. Sanders & Elvin, comb. et stat. nov. Basionym: *Monardella candicans* Bentham var. *venosa* Torrey, Pacific Railr. Rep. 4(5): 123. 1857. *Monardella douglasii* Bentham var. *venosa* (Torrey) Jepson, Fl. Calif. 3: 443. 1943. *Monardella douglasii* Bentham subsp. *venosa* (Torrey) Jokerst, Phytologia 72: 12. 1992. TYPE: U.S.A. California: Yuba Co., plains of the Feather River near Marysville, 25 May 1854, *Bigelow s.n.* (holotype, NY not seen; isotypes, GH not seen, US not seen).

Monardella douglasii Bentham var. *parryi* Jepson, Man. Fl. Pl. Calif. 884. 1925. TYPE: U.S.A. California: Butte Co., Chico, May 1882, *C. C. Parry s.n.* (holotype, UC 104634; isotype, UC 104635).

Discussion. *Monardella venosa* is recognized at the species level. Jepson (1943) first recognized the close relationship between *M. douglasii* and *M. venosa* by making *M. venosa* a variety within *M. douglasii.* Jokerst (1992) also recognized this close relationship and elevated *M. venosa* to the subspecific level. We now recognize *M. venosa* as a full species, but maintain that there is a close relationship between the two species.

Distribution and ecology. *Monardella venosa* occurs in the foothills of the western Sierra Nevada and southwestern Cascade mountain ranges in Butte, Mono, Tuolumne, and Yuba counties, California. It is morphologically distinct from *M. douglasii* in bract shape, size, and architecture; glomerule size; and stem stoutness and is therefore treated as a separate species. There are no collections that we have seen that express intermediate characters between *M. venosa* and either *M. douglasii* or *M. candicans.* It is biologically isolated from *M. douglasii* because the two species are separated by the floor of the San Joaquin–Sacramento Valley, a distance of more than 90 km with no suitable habitat.

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Description of Four New Species of *Bulbophyllum* (Orchidaceae) from Madagascar

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Abstract. Four new orchid species from Madagascar are described and illustrated. Notes on the distribution, ecology, and conservation status are provided. *Bulbophyllum uroplatoides* Hermans & G. A. Fischer, *B. histrionicum* Reichenbach f. ex G. A. Fischer & P. J. Cribb, and *B. senghasii* G. A. Fischer & Sieder belong to section *Calamaria* Schlechter, whereas *B. bryophytoides* G. A. Fischer & Andriantiana belongs to section *Lichenophylax* Schlechter. *Bulbophyllum uroplatoides* Hermans & G. A. Fischer is related to *B. cardiobulbum* Bosser, but differs in the thickened racemes, overall plant size, the shape of the sepals, petals, and lip, and coloration. *Bulbophyllum histrionicum* Reichenbach f. ex G. A. Fischer & P. J. Cribb was previously recognized by Reichenbach as a new species, but was never formally described. It is characterized by its large, orbicular to somewhat ovoid pseudobulbs that are green flushed with red, large, ovate-oblong to ovate-lanceolate leaves, red floral bracts, long sepals, narrowly triangular petals, and glabrous lip. *Bulbophyllum senghasii* G. A. Fischer & Sieder has orbicular, non-compressed bifoliate pseudobulbs, flowers with greenish yellow sepals that are spotted with dark brown on the outside, and an elliptic lip that is not compressed in the middle and has erose rather than long-ciliate margins and falcate rather than straight stelidia. *Bulbophyllum bryophytoides* G. A. Fischer & Andriantiana is a very tiny plant distinguishable from other species of section *Lichenophylax* by its densely long-ciliate petals and its ciliate lip that lacks a median callus and has a glabrous surface.

Résumé. Quatre nouvelles espèces d'orchidée de Madagascar sont décrites et illustrées. Notes sur la distribution, écologie et sur le statut de conservation sont fournis. *Bulbophyllum uroplatoides* Hermans & G. A. Fischer, *B. histrionicum* Reichenbach f. ex G. A. Fischer & P. J. Cribb, et *B. senghasii* G. A. Fischer & Sieder appartiennent à la section *Calamaria* Schlechter tandis que *B. bryophytoides* G. A. Fischer & Andriantiana appartient à la section *Lichenophylax* Schlechter. *Bulbophyllum uroplatoides* Hermans & G. A. Fischer est etroitement apparenté au *B. cardiobulbum* Bosser, mais le port de la plante, le modèle, la coloration des sépales et pétales ainsi que la grappe épaisse les differencie. *Bulbophyllum histrionicum* Reichenbach f. ex G. A. Fischer & P. J. Cribb préalablement reconnu par Reichenbach comme nouvelle espèce mais jamais décrite ni publiée formellement. Il est bien caractérisé par des pseudobulbes larges, spheriques un peu ovoides, feuilles ovales-oblongs à ovales-lancéolées, larges de couleur verte empourprée, bractée florale rouge, sépales longues, pétales étroitement triangulaires et labelle glabre. *Bulbophyllum senghasii* G. A. Fischer & Sieder a des pseudobulbes bifoliés, non comprimés, sphériques (orbiculaires), fleurs à sépales jaunes verdatres, tachetéés brunies vers l'extérieur, labelle elliptique non-comprimé au milieu à bordure plutot rongée que longuement ciliée, stelidie plutot falciforme que rectiligne. *Bulbophyllum bryophytoides* G. A. Fischer & Andriantiana est une plante tres petite, distinguable facilement des autres espèces de la section *Lichenophylax* par ses pétales densement long-cilées et labelle cilié sans callus median et à surface glabre.

Key words: *Bulbophyllum*, IUCN Red List, Madagascar, Orchidaceae.

The first taxonomic treatment of *Bulbophyllum* Thouars for Madagascar and the Mascarenes was

completed at the beginning of the 19th century (Thouars, 1822), and Thouars described 16 species of *Bulbophyllum* including *B. nutans* Thouars, the type species of the genus. Cordemoy (1893) later listed 15 species for La Réunion. Schlechter (1924) described 117 species of *Bulbophyllum* for Madagascar in his work *Orchidaceae Perrieranae*, which he attributed to 19 sections. His classification is, with some adaptations, still used today.

A milestone for the knowledge of the orchids of Madagascar was the publication of Perrier de la Bâthie (1939). In his comprehensive account (still forming the basis for all taxonomic treatments up to the present), he described in detail 179 species of *Bulbophyllum* for Madagascar. During the past four decades, Bosser and collaborators (Bosser, 1965, 1969, 1971, 1989, 2000, 2004; Bosser & Cribb, 2001) published several papers on Malagasy *Bulbophyllum*, including sectional treatments and new descriptions. Currently, some 211 species names (including several varieties) are accepted for Madagascar and the Mascarenes; 26 species names are unclear and in need of revision. Checklists of the orchids of Madagascar have been published by Du Puy et al. (1999) and Hermans et al. (2007). Recently, the number of sections was extended to 20 (Fischer et al., 2007a).

During the past four years, the genus *Bulbophyllum* in Madagascar was intensively investigated using phylogenetic and molecular methods (Fischer et al., 2007b). Several botanical surveys were undertaken in various parts of Madagascar. During this work, three new species belonging to section *Calamaria* Schlechter and one new species belonging to section *Lichenophylax* Schlechter were discovered and are described here. Notes on their distribution, ecology, and conservation are provided.

I. Bulbophyllum sect. **Lichenophylax** Schlechter.

Section *Lichenophylax* was established by Schlechter (1924) for a group of unique species endemic to the humid forests of eastern Madagascar. All species are tiny creeping plants clearly characterized by a ramified rhizome, ovoid to oblong bifoliate pseudobulbs, and a setaceous and uniflorous inflorescence.

1. Bulbophyllum bryophytoides G. A. Fischer & Andriantiana, sp. nov. TYPE: Madagascar. Toamasina: Distr. Maroantsetra, Sahantaha, Mt. Anjanaharibe, 800 m, 15°10′56″S, 49°37′17″E, very local, 19 Nov. 2005, *G. A. Fischer & Andriantiana FS2595* (holotype, WU). Figure 1.

Affine *Bulbophyllo lichenophylaci* Schlechter et *B. afzelii* Schlechter sed petalis dense longiciliatis, labello ciliato ecalloso glabro et sepalis 6–8 mm longis (9–10 mm longis in *B. afzelii*; 10–12 mm longis in *B. lichenophylace*) satis differt.

Rhizome 0.6–1 mm diam., nodes slightly swollen; roots 0.25–0.35 mm diam.; rhizome sheaths tubular, membranous, covering the new growth and bulb bases, disintegrating when old; pseudobulbs green, bifoliate, orbicular to elliptic, 2–3 × 1.3–1.6 mm, 5–7 mm apart. Leaves green, elliptic, acute, ca. 6 × 3.5 mm, tip acuminate, thin and very soft. Inflorescence 20–30 mm, single-flowered; peduncle erect, not swollen, setaceous, with 2 to 3 sheaths, ending in 1 terminal flower; peduncle sheaths tubular, 2–3 mm, caudate, membranous; floral bracts triangular, ca. 2 mm, membranous, slightly keeled, tip acuminate, base broadly attached. Flower resupinate, apically drooping from the pedicel and peduncle; pedicel and ovary 0.5–0.6 mm, subulate; sepals purple; dorsal sepal oblong-ovate to oblong, 6–7 × 1.5–2 mm, tip caudate, margins finely ciliate, 3-nerved, surface glabrous; lateral sepals free, 3-nerved, slightly recurved toward the tips, 7–8 × 3–3.5 mm, tips caudate, margins entire to very finely ciliate toward the base, base broadly attached; petals blackish purple with a whitish cream base, ovate, 5–5.2 × 2–2.3 mm, margins densely whitish long-ciliate, 1-nerved, surface finely papillose; lip blackish purple, recurved, elliptic to ovate-oblong in outline, tip rounded, margins over the entire length with seam-like lateral lobes that are densely ciliate, set apart from the median part of the lip by 2 ridges that alternate toward the tip, the median part with a very small slit continuing for 1/4 of the lip, surface glabrous; column white, from the base of the free part up to the tip of the stelidia 1.7–2 mm, with distinct, very short, truncate stelidia; column not winged, with a basal distinct tooth at its median margins; anther ca. 0.5 × 0.5 mm, with a median ridge, surface finely and slightly rugose; anther white; pollinia 4.

Distribution and habitat. The new species is only known from the type collection in wet montane forest between 600 and 1000 m in rather shady places at the base of trunks on Mount Anjanaharibe, northwest of Maroantsetra.

IUCN Red List category. The species seems to be very rare and restricted in distribution; it must be considered as Endangered (EN) following the IUCN (2001) criteria.

Etymology. The habit of the plant without flowers resembles the mat-like growth form of moss, and therefore this species is named *Bulbophyllum bryophytoides*.

Taxonomic relationships. This species is unique within section *Lichenophylax* because of the densely

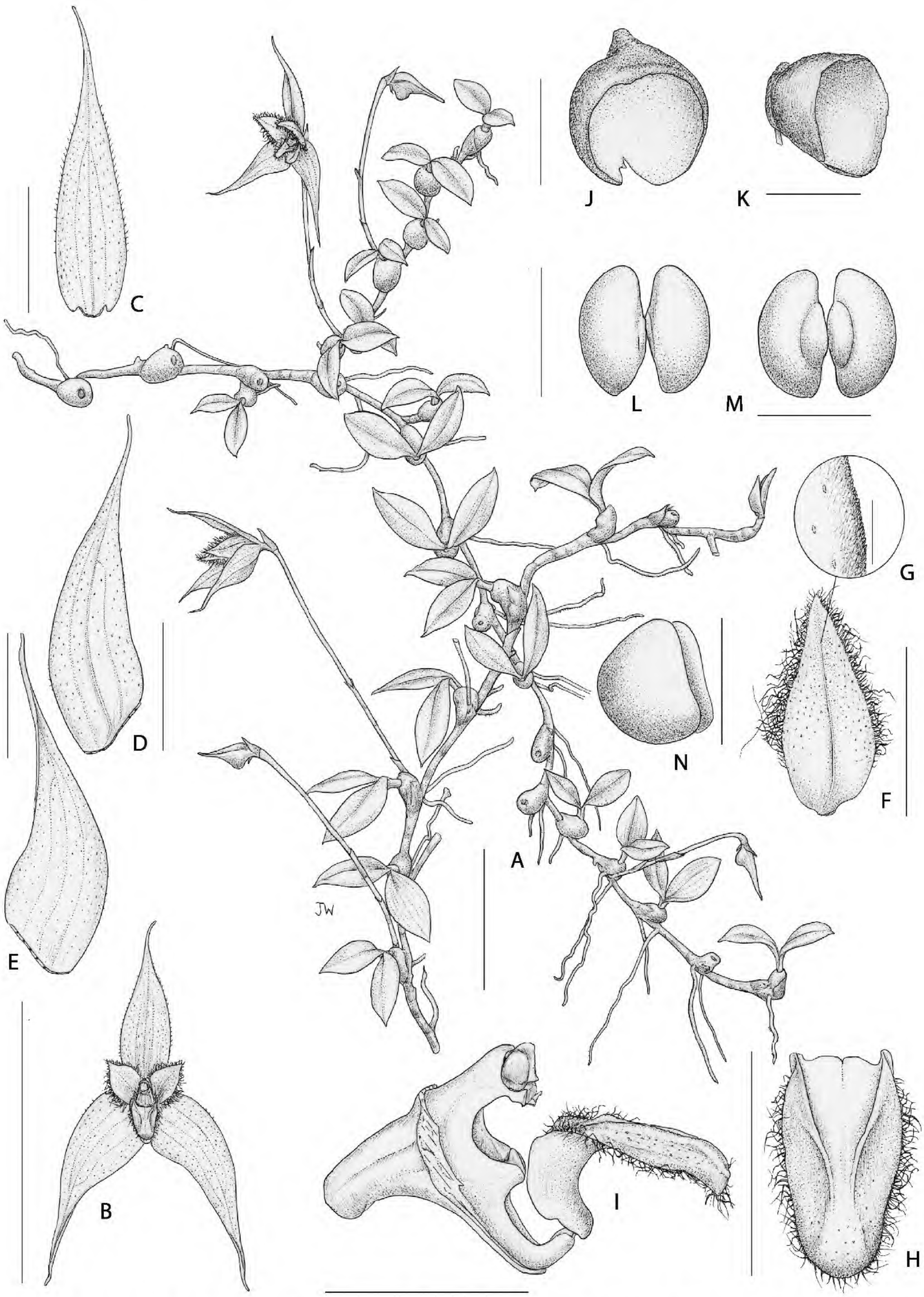

Figure 1. *Bulbophyllum bryophytoides* G. A. Fischer & Andriantiana. —A. Habit. —B. Flower, frontal view. —C. Dorsal sepal. —D. Lateral sepal, abaxial view. —E. Lateral sepal, adaxial view. —F. Petal, abaxial view. —G. Petal, detail of surface structure of central ridge, abaxial view. —H. Labellum, top view. —I. Column with labellum, side view. —J. Anther cap, front view. —K. Anther cap, side view. —L. Pollinia, back view. —M. Pollinia, front view. —N. Pollinia, side view. Drawn from the holotype *G. A. Fischer & Andriantiana FS2595* (WU) by Juliet Beentje. Scale bars: A, B = 1 cm; C–F = 3 mm; G, I = 2 mm; H–N = 0.3 mm.

long-ciliate petals and the ciliate, glabrous lip without a median callus.

II. Bulbophyllum sect. **Calamaria** Schlechter.

Schlechter (1924) first used the name *Calamaria* for a group of orchids that occur in Madagascar, the Comoros, the Mascarenes, and Africa. Section *Calamaria* is characterized by ovoid to orbicular, sometimes flattened, unifoliate or bifoliate pseudobulbs. The inflorescence is a many-flowered raceme with a rachis as thick as the peduncle or swollen, with the flowers inserted into dimples. The floral bracts cover the whole flower or at least the pedicel and ovary of the flowers, which are arranged in rows or spirally. The sepals are glabrous or verrucate, rarely fine hairy, with always entire margins. The lateral sepals are free. The lip is thick, recurved in the middle, with glabrous to long hairy margins. The stelidia are linear, falcate or recurved, and acute to acuminate. The anther has a protrusion that is often as long or longer than the stelidia. All species are adapted to drought through succulent vegetative parts.

2. Bulbophyllum histrionicum Reichenbach f. ex G. A. Fischer & P. J. Cribb, sp. nov. TYPE: Madagascar. Diego-Suarez/Antsiranana: Sous-préfecture de Vohemar, commune rurale de Daraina, forêt d'Antsahabe, 310 m, 13°10′37″S, 49°33′15″E, formation végétale humide de basse altitude le long d'un cours d'eau, substrat assez rocailleux, 30 Apr. 2004, *P. Ranirison 733* (holotype, G; isotype, WU). Figure 2.

Affine *Bulbophyllo pervillei* Rolfe sed pseudobulbis viridibus rubro-suffusis orbicularibus vel ovoideis, 2–3 × 1.8–2.7 cm, foliis ovato-oblongis vel oblongo-lanceolatis, 3–4 cm longis, inflorescentia usque ad 35-flora, bracteis rubris, ca. 4 mm longis, sepalis ca. 7 mm longis, petalis anguste triangularibus et labello glabro satis differt.

Rhizome 2–3 mm diam., nodes not swollen, roots 0.4–0.7 mm diam.; rhizome sheaths tubular, covering the base of the pseudobulbs and the new growth, disintegrating when old; pseudobulbs green suffused with red, bifoliate, orbicular to slightly ovoid, 1–2 mm apart at maximum, often touching each other or imbricate, arranged like in a mosaic, flattened, 2–3 × 1.8–2.7 cm, not angled. Leaves green yellowish sometimes suffused with red, ovate-oblong to oblong-lanceolate, 3–4 × 1–1.2 cm, tip obtuse to slightly oblique, very thick, coriaceous. Inflorescence 20–30 cm, up to 35 flowers; peduncle arising horizontally, red, not swollen, 8–12 cm long, 1 mm diam., with 4 to 5 sheaths; peduncle sheaths tubular, ca. 1 cm, tip acute, membranous, with nerves, glabrous; rachis red, pendulous, swollen at the nodes, subulate, 12–18 cm, glabrous to fine granulate; floral bracts red, triangular, ca. 4 × 1 mm, tip acute, base broadly attached, membranous, glabrous; flowers spiraling in a rather lax raceme, many flowers open simultaneously; pedicel and ovary glabrous, ca. 2.5 mm, jugae ending in a short tooth. Dorsal sepal fire red, ovate-lanceolate, ca. 7 × 2 mm, 1-nerved, tip caudate, margins entire, glabrous, base broadly attached, slightly keeled, concave (cap-like) hiding the top part of the column; lateral sepals fire red, free, narrowly triangular with a broad base, ca. 7 × 3.5 mm, 1-nerved, tip caudate, margins entire, glabrous, base broadly attached; petals white with red margins, not recurved, slightly falcate and narrowly triangular, 1-nerved, margins entire, glabrous, thin, base broadly attached; lip fire red, recurved, fleshy, glabrous, not ciliate, abaxially with a median furrow; column white with some red spots, 2–3 mm from the base of the free part up to the tip of the stelids, with rather short broad, triangular stelids, slightly winged below the base of the stelids; anther ca. 0.7 × 0.7 mm, papillose; pollinia 4, the inner 2 very small.

Distribution and habitat. *Bulbophyllum histrionicum* is endemic to northern Madagascar in dry to subhumid lowland forests, between 100 and 350 m, including the Tsingys of Ankarana.

IUCN Red List category. This species seems to be very rare and restricted in distribution; it must be considered as Endangered (EN) following the IUCN (2001) criteria.

Etymology. The reason Reichenbach chose the epithet formed from the Latin "histrionia," meaning "the art of acting" or "dramatic," is not known, but it probably refers to the showy habit of this species.

Notes. Reichenbach considered publishing *Bulbophyllum histrionicum*, as noted on the label of material examined by him (Herb. Mus. Palat. Vindob. Reichenbach: Herb Orchid. No. 9655), but never published a valid description. We therefore name this species *B. histrionicum* as proposed by Reichenbach.

Taxonomic relationships. *Bulbophyllum histrionicum* is related to *B. pervillei*, which only occurs in eastern humid coastal forests. The elliptic leaves, the laxly flowered inflorescence, the yellowish ovate-oblong sepals with an acuminate tip, the ovate-oblong petals, and the strongly papillose lip distinguish *B. pervillei* from *B. histrionicum*.

Paratypes. MADAGASCAR. **Antsiranana:** Daraina, Bekramosy, 13°14′17″S, 49°37′24″E, 27 Oct.

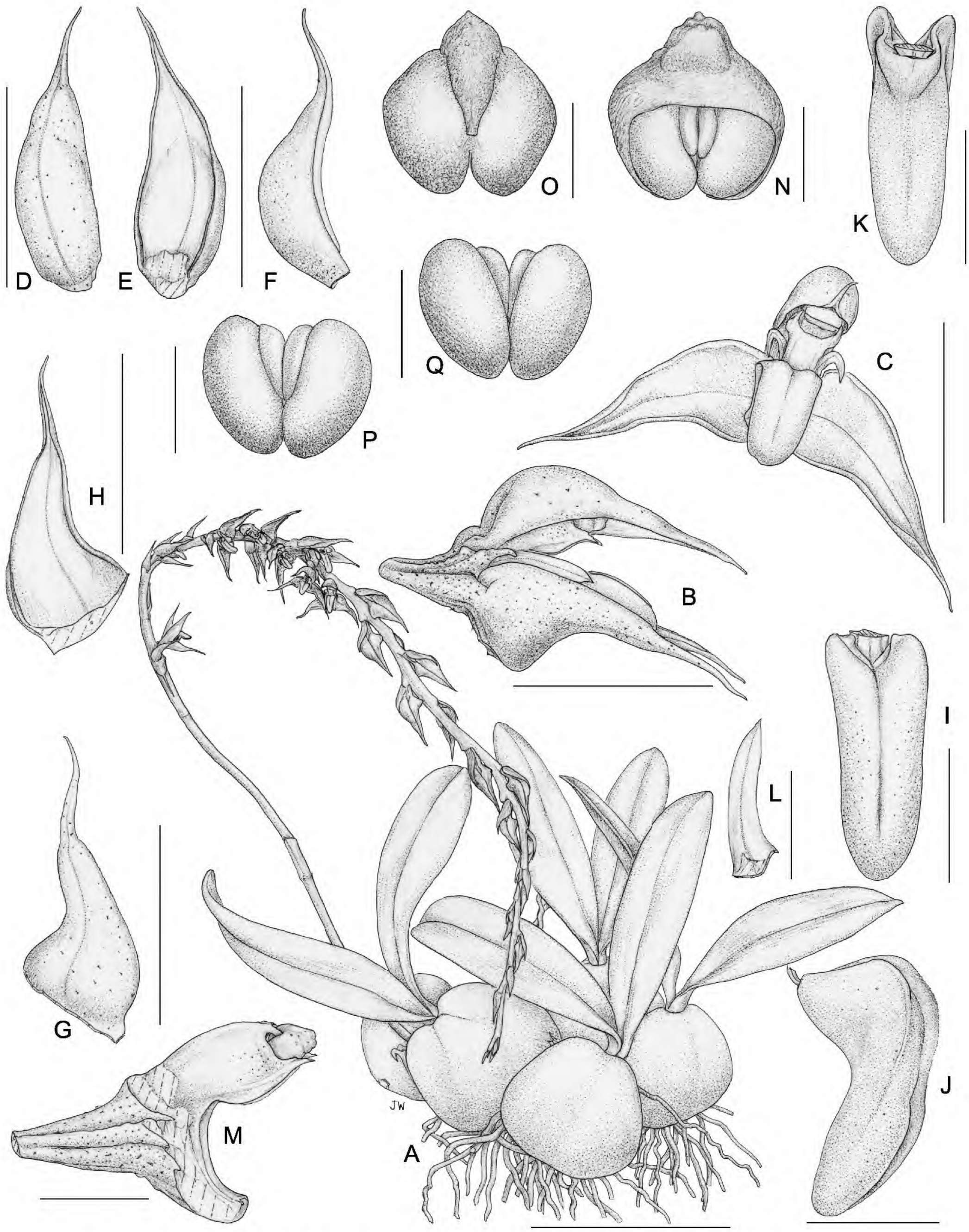

Figure 2. *Bulbophyllum histrionicum* Reichenbach f. ex G. A. Fischer & P. J. Cribb. —A. Habit. —B. Flower, side view. —C. Flower, frontal view. —D. Dorsal sepal, abaxial view. —E. Dorsal sepal, adaxial view. —F. Dorsal sepal, side view. —G. Lateral sepal, abaxial view. —H. Lateral sepal, adaxial view. —I. Labellum, front view. —J. Labellum, side view. —K. Labellum, back view. —L. Petal. —M. Column, side view. —N. Anther cap, front view. —O. Anther cap, back view. —P. Pollinia, front view. —Q. Pollinia, back view. Drawn from the holotype *P. Ranirison 733* (G) by Juliet Beentje. Scale bars: A = 3 cm; B–H = 5 mm; I–M = 2 mm; N–Q = 0.5 mm.

2004, *Fischer et al. FS1232* (WU); Daraina, 13°13′S, 49°34′30″E, 28 Oct. 2004, *Fischer et al. FS1295* (WU); Anivorano du Nord, 12°44′S, 49°13′E, 17 Apr. 1970, *J. Bosser 20220* (P 323161); massif calcaire de l'Ankarana, 12°55′S, 49°6′E, 10 Mar. 1990, *M. Bardot-Vaucoulon 145* (P 323188); Tsingy du Lac-Vert, Massif de l'Ankarana, 12°55′S, 49°6′E, 23 Mar. 1991, *M. Bardot-Vaucoulon 463* (P 323189); s. loc., Herb. Mus. Palat. Vindob. Reichenbach: Herb Orchid. No. 9655 (W).

3. Bulbophyllum senghasii G. A. Fischer & Sieder, sp. nov. TYPE: Madagascar. 100 mi. S of Antananarivo, in forest reserve, very local, fl. in cult., 30 Oct. 1961, *Mason 78* (holotype, K 14850). Figure 3.

Affine *Bulbophyllo sambiranensi* Jumelle & H. Perrier sed pseudobulbis orbiculariibus non-compressis, foliis ellipticis 2.5–3.5 × 1.5–2 cm, floribus flavoviridibus atrobrunneomaculatis, labello flavo in medio non-compresso margine eroso et stelidiis falcatis satis differt.

Rhizome ca. 2 mm diam., nodes not swollen, roots 0.4–0.6 mm diam.; rhizome sheaths tubular, membranous, covering the base of the pseudobulbs, disintegrating when old; pseudobulbs green, bifoliate, orbicular, 1.5–2 × 1.5–2 cm, 0.5–1 cm apart, not flattened, not angled. Leaves green, elliptic, obtuse, 2.5–3.5 × 1.5–2 cm, tip retuse, coriaceous, very thick. Inflorescence 10–15 cm, up to 30 flowers; peduncle erect, swollen toward the rachis, apical drooping and torsion of the apex, with 5 to 6 sheaths; peduncle sheaths tubular, 5–6 mm, keeled, rounded to truncate, membranous with nerves; rachis swollen, spindle-shaped, 5–7 cm, 4 mm diam., subulate, with fine rugosities; floral bracts recurved, ovate, ca. 6 × 2 mm, membranous, central nerve keeled, with fine rugosities, tip acute, base broadly attached; flowers placed in 3 rows, in a rather dense raceme with dimples, giving a deltoid and imbricate impression at the apex where the floral bracts cover the flower buds, many flowers opening simultaneously; pedicel and ovary ca. 1 mm long, covered with fine rugosities; jugae ending in short acute tooth; sepals yellow adaxially, greenish yellow abaxially with some dark brown spots; dorsal sepal not recurved, ca. 4.5 × 1.5 mm, narrowly elliptic to oblong, concave, cap-like, suffused with small rugosities, margins entire, thick, base broadly attached, tip acute to acuminate; lateral sepals free, slightly recurved, falcate, ca. 3.5 × 2 mm, suffused with small rugosities, margins entire, base broadly attached, tips acuminate; petals white, linear acute, ca. 2 × 0.5 mm, margins entire, glabrous, base broadly attached; lip dark yellow, recurved, elliptic in outline, median part not compressed, ca. 2.5 × 1.3 mm, tip very thick, truncate, margins with a narrow seam with edges that are erose, surface glabrous, lateral sides finely papillose, abaxially with a central furrow; column white, ca. 2 mm long from the base of the free part up to the tip of the stelids, winged below the base of the stelids; stelids acute to acuminate, falcate, ca. 0.5 mm; anther ca. 0.5 × 0.6 mm, yellow, with a warty and papillose filament; pollinia 4.

Distribution and habitat. The distribution of *Bulbophyllum senghasii* is unknown because the species is known only from the type collection.

IUCN Red List category. The species seems to be very rare and restricted in distribution; it must be considered as Endangered (EN) following the IUCN (2001) criteria.

Etymology. The species is named in honor of the late Karlheinz Senghas, the former curator of the Heidelberg Botanic Garden, who collected the paratype on one of his trips to Madagascar together with Werner Rauh.

Taxonomic relationships. Bulbophyllum sambiranense Jumelle & H. Perrier, which is closely related to *B. senghasii*, is clearly distinguishable by the compressed pseudobulbs and the ciliate margins of the lip.

Paratype. MADAGASCAR. *K. Senghas & W. Rauh s.n.*, cult. HBV 099B60-1 (WU).

4. Bulbophyllum uroplatoides Hermans & G. A. Fischer, sp. nov. TYPE: Madagascar. Antsiranana: Edge of Anjanaharibe reserve, near Andranotsarabe, in dense forest, 1050 m, Nov. 1994, *J. Hermans 3400* (holotype, K). Figure 4.

Affine *Bulbophyllo cardiobulbo* Bosser sed pseudobulbis 2–3.5 cm diam., inflorescentia laxe 15- ad 18-flora, sepalis lanceolatis vel lineari-lanceolatis 7–8 mm longis casteneis, petalis cremeis rubro-marginatis et labello ca. 6 mm longo carmineo ad basin cremeo ad margines verrucoso et columna alba ad basin rubroguttata satis differt.

Rhizomes 4–5 mm diam., completely hidden by the pseudobulbs; roots 0.5–1 mm diam., wiry, glabrous; rhizome sheaths membranous; pseudobulbs pale green-yellow, becoming yellow with age, bifoliate, ovate to orbicular, with sharp edges, very strongly flattened, 2–3.5 cm diam., partly covering each other. Leaves pale green, oblong to ligulate, base very shortly petiolate, 2–4.5 × 1–2 cm, tip oblique, midrib obscure. Inflorescence up to 22 cm long, laxly 15- to 18-flowered, semi-erect; peduncle 13–15 × 0.2–0.3 cm, emerging from behind the pseudobulbs where the base is covered by a triangular sheath, slightly

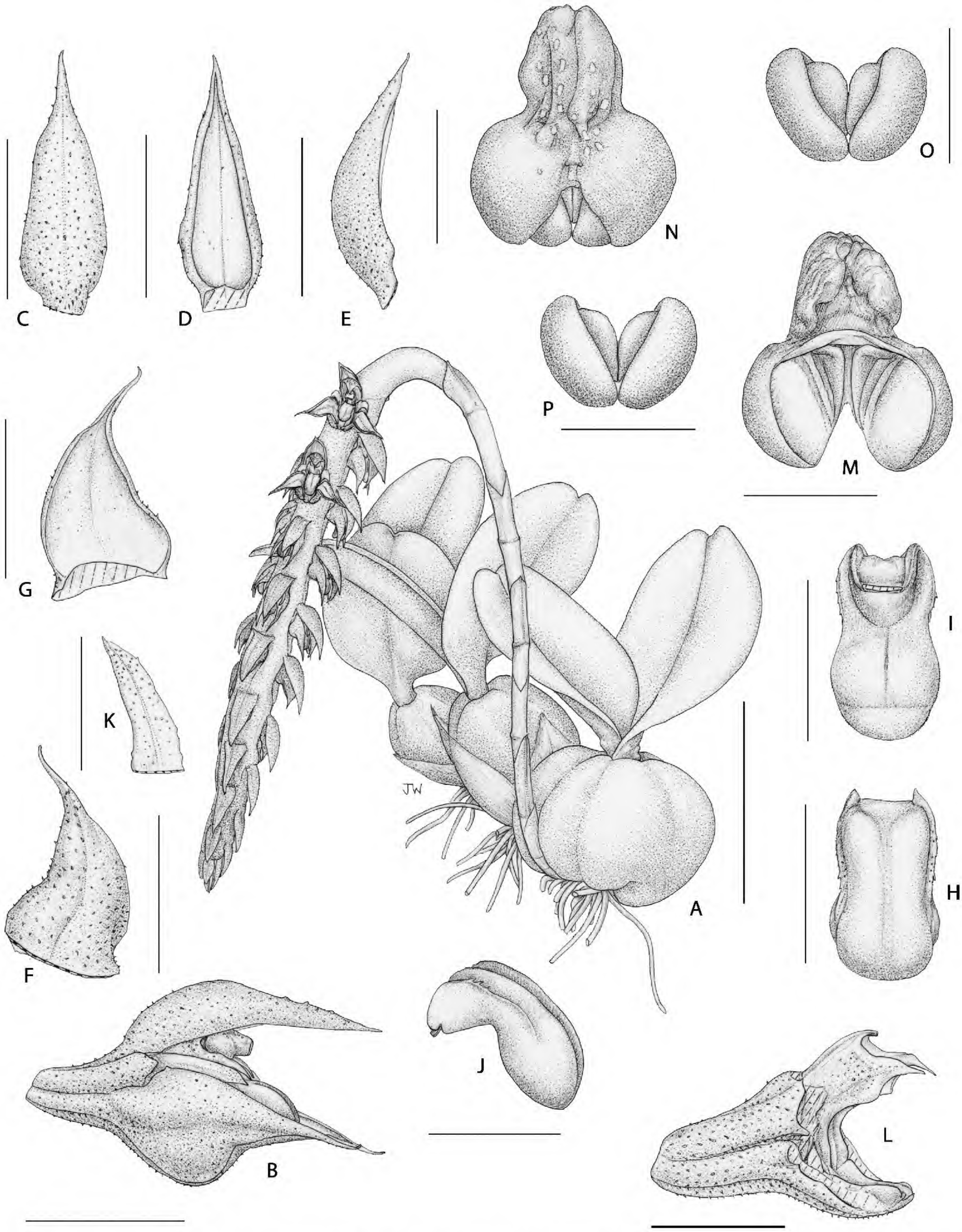

Figure 3. *Bulbophyllum senghasii* G. A. Fischer & Sieder. —A. Habit. —B. Flower, side view. —C. Dorsal sepal, abaxial view. —D. Dorsal sepal, adaxial view. —E. Dorsal sepal, side view. —F. Lateral sepal, abaxial view. —G. Lateral sepal, adaxial view. —H. Labellum, front view. —I. Labellum, back view. —J. Labellum, side view. —K. Petal. —L. Column, side view. —M. Anther cap, front view. —N. Anther cap, back view. —O. Pollinia, front view. —P. Pollinia, back view. Drawn from the holotype *Mason 78* (K) by Juliet Beentje. Scale bars: A = 2 cm; B–G = 3 mm; H–L = 2 mm; M–P = 0.5 mm.

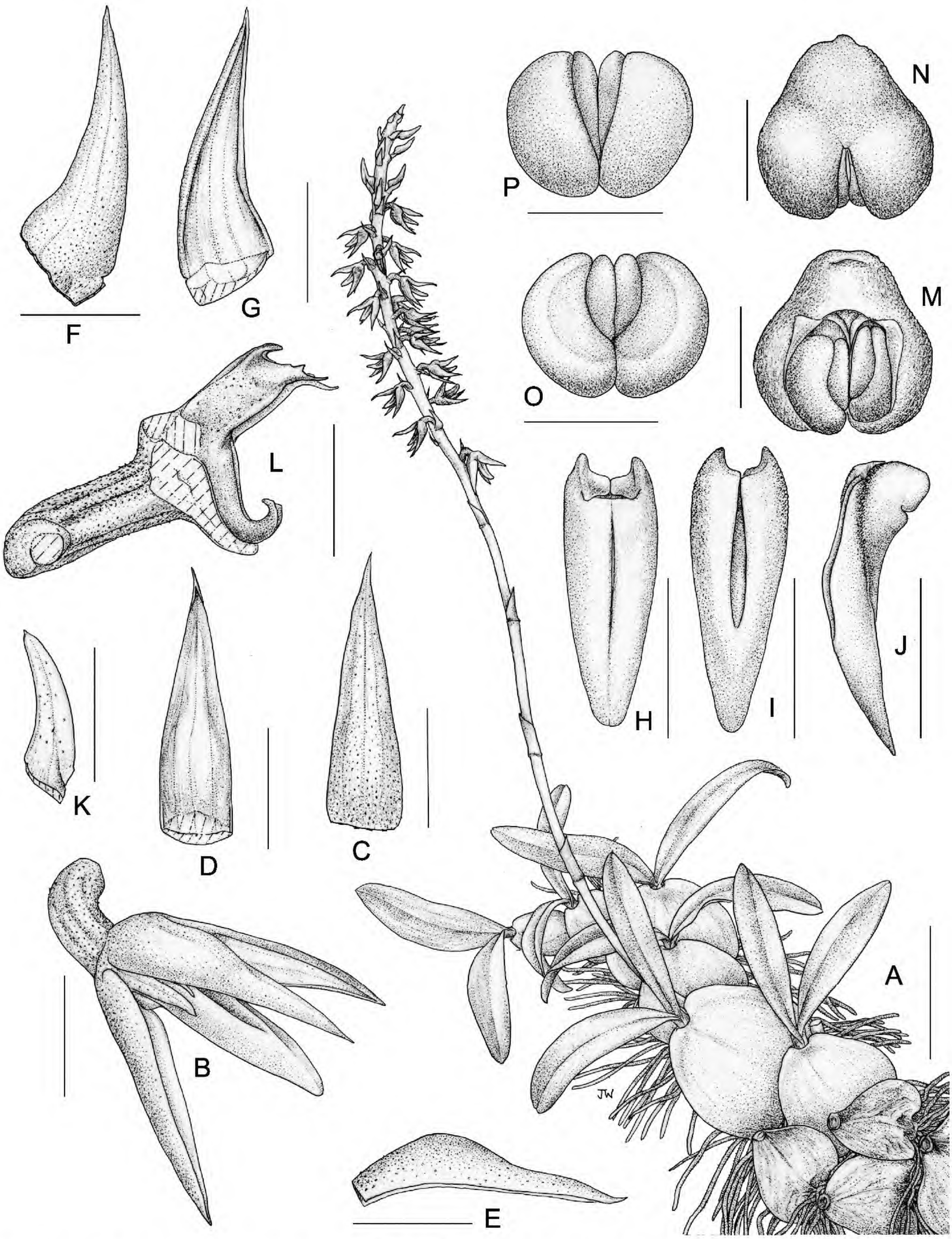

Figure 4. *Bulbophyllum uroplatoides* Hermans & G. A. Fischer. —A. Habit. —B. Flower. —C. Column, abaxial view. —D. Dorsal sepal, adaxial view. —E. Dorsal sepal, side view. —F. Lateral sepal, abaxial view. —G. Lateral sepal, adaxial view. —H. Labellum, back view. —I. Labellum, front view. —J. Labellum, side view. —K. Petal, abaxial view. —L. Column, side view. —M. Anther cap, front view. —N. Anther cap, back view. —O. Pollinia, front view. —P. Pollinia, back view. Drawn from the holotype *Hermans 3400* (K) by Juliet Beentje. Scale bars: A = 3 cm; B–J = 3 mm; K, L = 2 mm; M–P = 0.5 mm.

compressed, brownish red, with 3 or 4 sheaths; peduncle sheaths tubular, 3–8 mm, membranous; rachis brownish red, 8–9 × 0.3–0.4 cm, surface slightly ridged and hollowed at the inset of the ovary; floral bracts 4–10 mm apart, lanceolate, acute, 4–6 mm long. Flowers ca. 8 × 8 mm, all approximately facing the same direction, in a lax raceme, mostly opening simultaneously; pedicel and ovary 2–3 × ca. 1.5 mm, subsessile, not resupinate; sepals chestnut with darker longitudinal marking; dorsal sepal not recurved, linear-lanceolate, 7–8 × 2–2.5 mm, base concave, tip acute, margins entire, glabrous; lateral sepals lanceolate, ca. 8 × 4 mm, concave, forming a ca. 2 mm mentum, tips acute; petals cream with red margins thin, narrowly triangular, ca. 2 × 0.75 mm, tip acute, margins entire; lip ca. 6 × 1.5 mm, crimson, cream at the base, articulate and mobile on the column foot, base recurved with a central fissure ca. 4 mm long from the base, glabrous but margins microscopically verrucose; column whitish yellow, foot spotted with red, ca. 1.5 mm from the base of the free part to the tips of the stelids, stelids slightly spreading, ca. 0.5 mm, with small rounded lobe along the upper margin; anther 0.9–1 mm diam., minutely verrucose; pollinia ca. 0.5 mm diam.

Distribution and habitat. *Bulbophyllum uroplatoides* is endemic to northern Madagascar in montane humid forests and has been collected from 1050 m altitude.

IUCN Red List category. The species is very rare and restricted in distribution; it must be considered as Endangered (EN) following the IUCN (2001) criteria.

Etymology. The species epithet refers to the leaf-tailed geckos (*Uroplatus* Duméril) of Madagascar, which are also found flattened against trees.

Taxonomic relationships. *Bulbophyllum cardiobulbum*, the closest relative of *B. uroplatoides*, differs in its very narrowly triangular sepals and petals and the very papillose and elongated lip that is compressed in the median part. The vegetative parts of both species are very similar but can be distinguished because those of *B. cardiobulbum* are larger in all parts.

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A New Hybrid Bromeliad from Southernmost Brazil, *Tillandsia* ×*baptistana*

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Abstract. A new putative natural hybrid bromeliad from southernmost Brazil, *Tillandsia* ×*baptistana* Gonçalves & Azevêdo-Gonçalves (Bromeliaceae), is here described. Its habit is very similar to *T. mallemontii* Glaziou ex Mez, but the floral characteristics are intermediate between the probable parental taxa (*T. recurvata* (L.) L. and *T. mallemontii*). A key to identify this hybrid and its parents on the basis of the floral characters is also presented.

Resumo. Uma nova bromélia, provável híbrida natural, *Tillandsia* ×*baptistana* Gonçalves & Azevêdo-Gonçalves (Bromeliaceae), é aqui descrita. Seu hábito é muito similar ao de *T. mallemontii* Glaziou ex Mez, enquanto suas características florais são intermediárias entre os táxons parentais (*T. recurvata* (L.) L. e *T. mallemontii*). Uma chave para identificar este híbrido e seus parentais, com base em caracteres florais, também é apresentada.

Key words: Brazil, Bromeliaceae, *Tillandsia*.

The genus *Tillandsia* L. has nearly 420 species and is widely distributed in the Neotropics (Smith & Downs, 1977; Winkler, 1982). However, few hybrids are known in the genus. During fieldwork in which we studied vascular epiphytes on the coastal plain of Rio Grande do Sul, the southernmost Brazilian state (Gonçalves & Waechter, 2002), we found a little *Tillandsia* that was further recognized as a previously unknown putative hybrid. We describe it herein, as follows:

Tillandsia ×**baptistana** Gonçalves & Azevêdo-Gonçalves, nothosp. nov. [= *Tillandsia mallemontii* Glaziou ex Mez × *T. recurvata* (L.) L.]. TYPE: Brazil. Rio Grande do Sul: Terra de Areia, epiphyte on a fallen branch near peat forest, 15 Dec. 1999 (fl., fr.), *C. N. Gonçalves & C. F. de Azevêdo-Gonçalves 244* (holotype, ICN 120.704; isotype, HAS). Figure 1.

Haec nothospecies inter *Tillandsiam mallemontii* Glaziou ex Mez et *T. recurvatam* (L.) L. hybrida putata est; a hac floribus (et plerumque statura) majoribus atque petalis remiformibus, ab illa petalis brevioribus pallide azureis atque antheris ovarioque brevioribus distinguitur.

Epiphytic herb 16–20 cm, grayish. Roots present. Stem, leaves, inflorescence, and bracts covered by radial scales. Stem 4–6 cm, dichotomous from its base to its apex, turned near the roots and covered by leaf bases. Leaves 3–9 cm, lanceolate, without petioles, densely covered by scales in both faces. Terminal inflorescences 7–10 cm, with a thin rachis, and 1 bract per flower 14–19 mm. Flowers semisessile, trimerous, commonly as pairs open at same time, or a bud and one flower open. Sepals suboblong to lanceolate, 10.4–12 mm, glabrous. Petals pale blue, 14.8–15.3 mm, with 11 laminar nerves, blade oar-shaped, suborbicular with suboblique apex, spreading at anthesis. Stamens 4.1–6.8 mm, exceeding the pistil; anthers 1.1–2.1 mm. Ovary cylindric, 3.8–4.1 mm, with a short thick pistil 1–1.3 mm. Fruit capsular with 3 valves. Seeds absent or imperfectly developed.

Etymology. This taxon is named in honor of Luís Rios de Moura Baptista, an eminent botanist from Rio Grande do Sul.

Habitat and distribution. *Tillandsia* ×*baptistana* is epiphytic on fig trees (*Ficus organensis* (Miquel) Miquel) near peat forest. To date, *T.* ×*baptistana* has been found only near the town of Terra de Areia (29°35′S, 50°06′W) in the coastal plain of Rio Grande do Sul, Brazil, where it is extremely rare (only three individuals found). However, it is to be expected wherever *T. recurvata* and *T. mallemontii* occur sympatrically, but it may be overlooked if not collected with flowers. In Rio Grande do Sul, 19 native species of *Tillandsia* were listed, but none of these was a natural hybrid (Winkler, 1980, 1982; Strehl, 2000). Therefore, *T.* ×*baptistana* is the first natural hybrid of *Tillandsia* found in this Brazilian state.

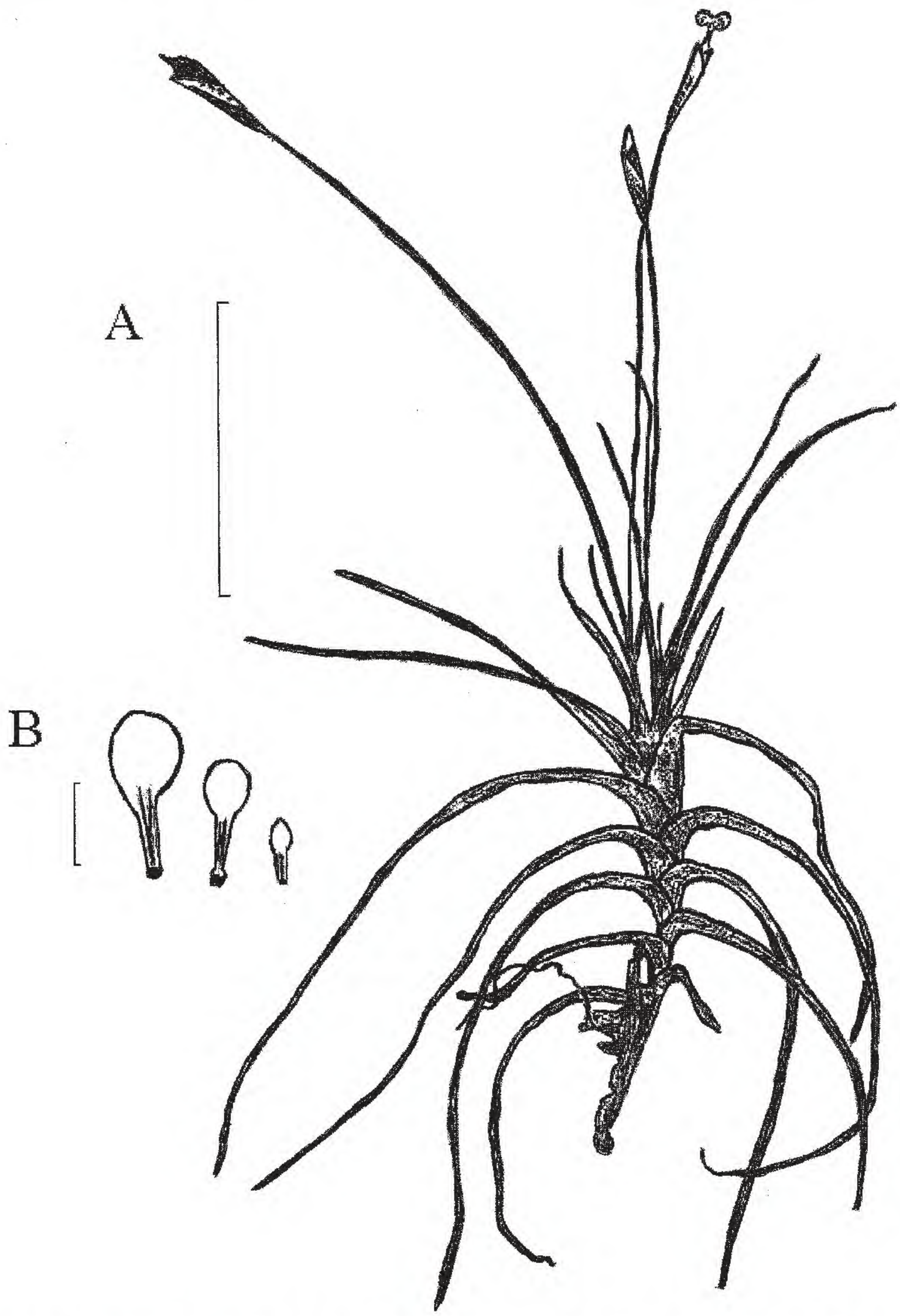

Figure 1. *Tillandsia* ×*baptistana* Gonçalves & Azevêdo-Gonçalves. —A. Habit. —B. Petals from *T. mallemontii* (left), *T.* ×*baptistana* (center), and *T. recurvata* (right). Scale bars: A = 5 cm, B = 1 cm. Drawn from the holotype, *C. N. Gonçalves & C. F. de Azevêdo-Gonçalves 244* (ICN).

Discussion. According to Smith and Downs (1977), hybrids of *Tillandsia* are relatively rare. They listed only 10 hybrid taxa of *Tillandsia* in their revision of Tillandsoidae. Few other hybrids have been described since then (Gardner, 1984; Luther, 1985), and some previously described species have been recognized as having a hybrid origin (Luther, 1989). However, Luther (1989) believes that many taxa described as species of *Tillandsia* are actually hybrids. In Brazil, only one natural hybrid (*T.* ×*donatoi* Leme) was previously described (Leme, 1987). The putative hybrid nature of *T.* ×*baptistana* is supported by the absence of viable seeds and by morphological characters intermediate between the two presumed parent taxa. Its phenology is also similar to *T. recurvata* and *T. mallemontii*.

Two individuals of *Tillandsia* ×*baptistana* were found as epiphytes on fig trees. One other was found on a fallen branch. Only this last individual was collected and partially vouchered. Another part of this plant was cultivated, and its mature capsules were collected to test the seed germination. The plant was maintained on the branch where it was found to avoid damage. The locale where this individual was cultivated is only 3.5 km from the site collection and has the same climate. Mature capsules from the

Table 1. Vegetative and floral measurements (in mm) and characteristics of *Tillandsia recurvata*, *T.* ×*baptistana*, and *T. mallemontii* from Rio Grande do Sul.

	T. recurvata	*T.* ×*baptistana*	*T. mallemontii*
Total plant length	70–135	160–200	140–270
Leaf length	20–90	30–90	30–95
Sepal length	8.6–7.9	10.4–12	13.4–15.3
Sepal width	3–3.1	3.6–4.1	4–5.1
Petal shape	sublinear to lanceolate	oar-shaped	oar-shaped
Petal color	white to pale blue	pale blue	blue to violet
Petal length	8–10.4	14.8–15.3	19–22.5
Petal width	1.6–2	4.1–5	8–10.5
Stamen length	3.9–5	4.1–6.8	6.1–6.8
Anther length	0.8–1.2	1.2–2.1	2.1–2.3
Ovary length	2.8–4.5	3.8–4.1	5–6
Pistil length	0.9–1.3	1–1.3	1.8–2.2

other two individuals were also collected. A total of 15 capsules were open and 11 were empty. Four capsules had only imperfectly developed seeds that failed to germinate. Other capsules observed in the cultivated plant were also empty. It is important to note that individuals of *T. recurvata* and *T. mallemontii* were also cultivated at the same locale, side by side with *T.* ×*baptistana*, and they presented many viable seeds.

Gonçalves and Waechter (2002) found nine *Tillandsia* species on isolated fig trees near the area where *T.* ×*baptistana* was found, including species of the subgenera *Anoplophytum* (Beer) Baker (*T. aeranthos* (Loiseleur) L. B. Smith, *T. gardneri* Lindley, *T. geminiflora* Brongniart, *T. stricta* Solander, and *T. tenuifolia* L. var. *surinamensis* (Mez) L. B. Smith), *Diaphoranthema* (Beer) Baker (*T. recurvata*, *T. tricholepis* Baker, and *T. usneoides* (L.) L.), and *Phytarrhiza* (Visiani) Baker (*T. mallemontii*). Only one other *Tillandsia* species (*T. crocata* (E. Morren) Baker of subgenus *Phytarrhiza*) was found in the forests of the same area (C. N. Gonçalves & C. F. de Azevêdo-Gonçalves, unpublished data).

The species belonging to subgenus *Anoplophytum*, as well as *Tillandsia usneoides* and *T. tricholepis*, are morphologically quite different from *T.* ×*baptistana* and may be promptly excluded as its parents. Although *T. crocata* occurs in the same geographic area and shares some morphological (leaves distichous-ranked, stem elongated) and floral characters (oar-shaped petals) with *T.* ×*baptistana*, it is rare and was not found in the immediate area where *T.* ×*baptistana* occurs. On the other hand, *T. recurvata* and *T. mallemontii* are extremely common in this area, especially the former species, and both were found growing with *T.* ×*baptistana* in the same trees. Of these three taxa, *T. recurvata* is the smallest. The maximum size of this species is 13.5 cm in the coastal plain of Rio Grande do Sul (to 23 cm in its whole occurrence area, according to Smith & Downs, 1977). However, it normally has an elongated stem and distichous-ranked leaves similar in aspect and dimensions to young individuals of *T.* ×*baptistana* and *T. mallemontii*. It is therefore somewhat difficult to distinguish one from another when they lack flowers. *Tillandsia* ×*baptistana* is very similar to *T. mallemontii* vegetatively, although individuals of *T. mallemontii* may have a more elongated stem (Table 1). The majority of the floral characters (sepals, stamens, anthers, and ovaries) of the three taxa are also similar in shape and form, but differ in size. Only the petals have a remarkable difference in shape: *T. recurvata* has sublinear to lanceolate petals and *T. mallemontii* has oar-shaped petals. In *T.* ×*baptistana*, the petals are also oar-shaped, but somewhat less defined than in *T. mallemontii*. The size of both the petals and sepals in *T.* ×*baptistana* is intermediate between *T. recurvata* and *T. mallemontii* (Fig. 2). The size of the stamens, ovaries, and pistils in *T.* ×*baptistana* overlaps the upper size range of these characters in *T. recurvata* (Table 1). The anthers of *T. recurvata* and *T.* ×*baptistana* are of equal size or slightly larger in *T.* ×*baptistana*, but are always smaller than in *T. mallemontii*.

Studies on floral biology and pollination, as well as species compatibility, are still lacking for *Tillandsia recurvata* and *T. mallemontii*. However, these two species flower in late spring to early summer (December to January) in the coastal plain of Rio Grande do Sul. Frequently, individuals of both species are found flowering at the same time in the same tree. So, it is not surprising that hybridization occurs between them. *Tillandsia* ×*baptistana* flowers at the same time, normally in December, but some flowers may occur occasionally in March or April.

Tillandsia ×*baptistana* is the first putative natural hybrid for species of *Tillandsia* from two different subgenera: *Phytarrizha* (*T. mallemontii*) and *Diaphoranthema* (*T. recurvata*). It is possible that these two species will be better classified together (in a unique subgenus). Only future phylogenetic work in *Tilland-*

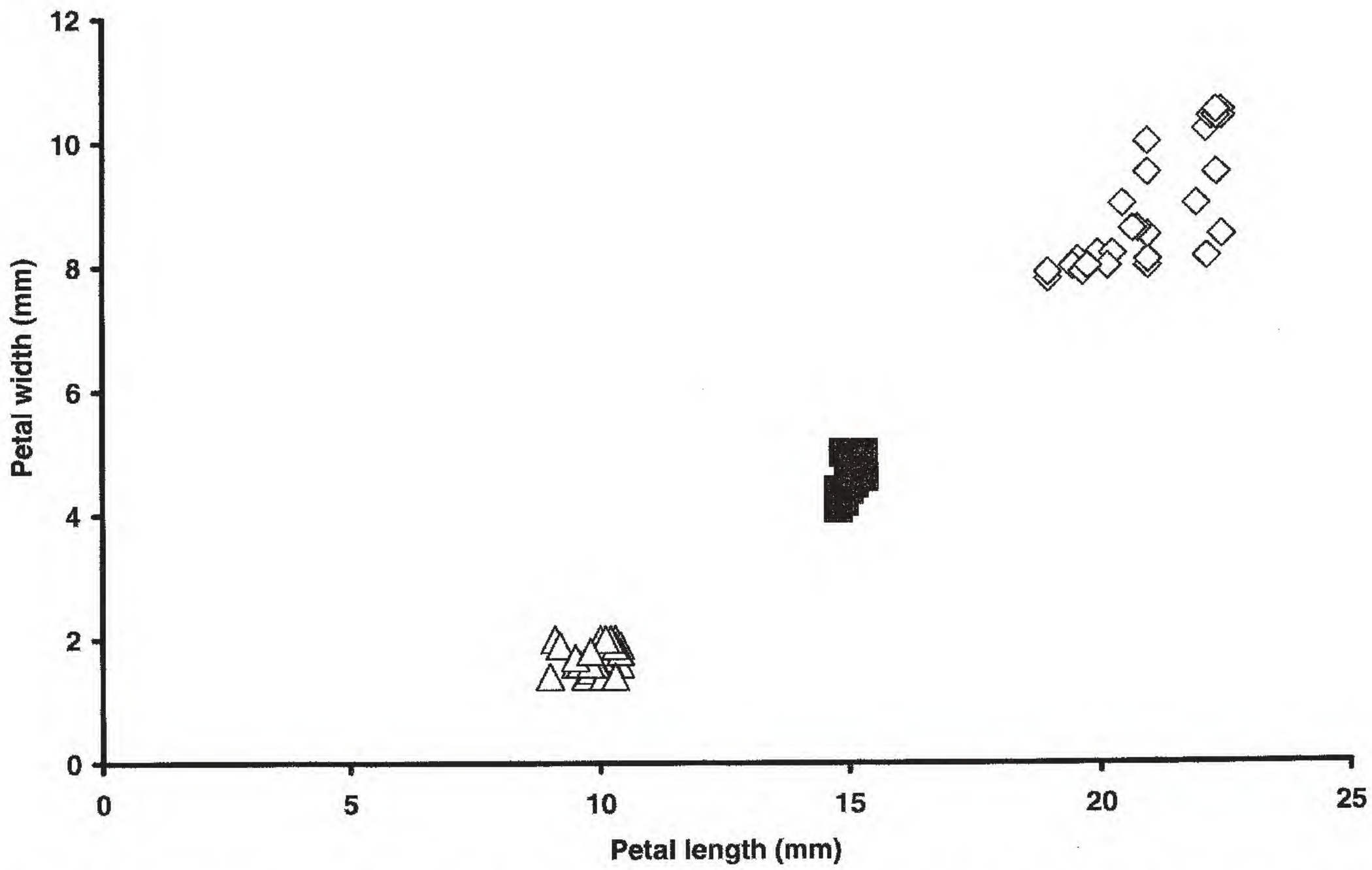

Figure 2. Comparison between petal length and width of *Tillandsia recurvata* (triangles, n = 30 flowers sampled), *T.* ×*baptistana* (filled squares, n = 15), and *T. mallemontii* (diamonds, n = 30).

sia (including these two species) will resolve this question appropriately.

Following is a key to identify *Tillandsia* ×*baptistana*, *T. recurvata*, and *T. mallemontii* from Rio Grande do Sul, Brazil:

1a. Flowers inconspicuous; petals 8–10.4 mm long, white to pale blue; stamens 3.9–5 mm long; anthers 0.8–1.2 mm long; ovaries 2.8–4.5 mm long; pistils 0.9–1.3 mm long . . . . . *T. recurvata*

1b. Flowers larger.

2a. Petals 14.8–15.3 mm long, pale blue; stamens 4.1–6.8 mm long; anthers 1.2–2.1 mm long; ovaries 3.8–4.1 mm long; pistils 1–1.3 mm long . . . . . *T.* ×*baptistana*

2b. Petals 19–22.5 mm long, blue to violet; stamens 6.1–6.8 mm long; anthers 2.1–2.3 mm long; ovaries 5–6 mm long; pistils 1.8–2.2 mm long. . . . . *T. mallemontii*

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A New Species of *Hoya* (Apocynaceae, Asclepiadoideae) from Hainan, China

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Abstract. A new species, *Hoya bawanglingensis* S. Y. He & P. T. Li (Apocynaceae, Asclepiadoideae), is described and illustrated from Hainan, China. The morphological characters of *H. bawanglingensis* and the related species *H. pottsii* Traill are compared. *Hoya bawanglingensis* differs in the pubescence of its young stems, both leaf surfaces, petioles, peduncles, pedicels, outer calyx lobes, and follicles. The corolla lobes are white with purple spots, and the corona is white with a purplish center.

Key words: Apocynaceae, Asclepiadoideae, China, Hainan, *Hoya*, IUCN Red List.

Hoya R. Brown (Apocynaceae, Asclepiadoideae) is a genus with at least 100 species distributed from Southeast Asia and Oceania. Thirty-two species are known from China (Li et al., 1995), most of which are found in Hainan, Yunnan, Guangdong, and Guangxi provinces. The genus is primarily distributed in Malaysia, where over 300 species are known, particularly from the Philippines, New Guinea, the western Pacific Islands, and Asia, including the Indian subcontinent. In Australia, there are six native species, among which are one endemic and one naturalized species (Forster & Liddle, 1996).

During our fieldwork on *Hoya* in Hainan Province, China, some unknown specimens of *Hoya* were collected that could not be placed in any of the previously described taxa from China (Tsiang & Li, 1974, 1977; Li et al., 1995) and Australia (Forster & Liddle, 1996), and this taxon is herein established as a new species.

Hoya bawanglingensis S. Y. He & P. T. Li, sp. nov. TYPE: China. Hainan Province: Bawangling, 19°07′N, 109°06′E, on tree in montane rainforest, 423 m, 8 Aug. 2007, *S. Y. He & J. Y. Lin 0708081* (holotype, CANT, photo MO). Figure 1.

Species *Hoyae pottsii* Traill affinis, sed caulibus juvenibus petiolis foliis utrinque pedunculis pedicellis calyce extra et folliculis pubescentibus, lobis corollinis albis purpureomaculatis atque corona alba mediano purpurea differt.

Plants epiphytic, scandent; stems and branches filiform, elongated, flexuose, terete, with purple maculae on young pubescent stems, aged stems glabrous. Leaves opposite, fleshy and leathery when dry, leaf blades ovate or elliptic, 7.5–10.5 × 3–4.5 cm, pubescent on both surfaces, green adaxially with some purple maculae, green abaxially with many purple maculae, apex acuminate or acute, base rounded or cordate, margin ciliate, 3-veined from base; petiole curved or twisted, terete, pubescent, dark purple or grayish green, ca. 1.2 cm long. Cymes subumbel-shaped with many flowers, ca. 12 to 25; rachis cylindrical; peduncle 7–10.5 cm, pubescent green with dark purple spots; pedicels filiform, slender, 2–2.2 cm, pubescent, white with purple spots. Calyx lobes overlapping at base, apex triangular, acuminate, outside scabrous; corolla rotate, reflexed, ca. 1 cm diam., lobes ovate, 4–7 × 4–5 mm, spreading, outside and inside white with purple spots, inside white pilose; corona raised in the center, lobes rhomboid, 3.5–4 × 2–2.5 mm, with side protrusions higher than inner, inner angles touching in center, white with purplish center, mucronate, outer angle acuminate, canaliculate on lower surface from base to apex; pollinia golden yellow, ca. 600 × 300 μm, germinating crest pellucid, extended to caudicle; caudicle wider toward pollinium, ca. 75 μm long; ovaries purplish white. Follicles fusiform, 8–10.5 × ca. 0.8 cm, dark purple; seeds linear-oblong, ca. 4 × 1 mm, brown or dark brown when dry, with white silky coma, ca. 3.5 cm.

Habitat. *Hoya bawanglingensis* was collected from mountain rainforest at 270–430 m altitude, on various species of trees, i.e., *Cleistocalyx operculatus* (Roxburgh) Merrill & L. M. Perry, *Ficus subpisocarpa* Gagnepain, *Machilus salicina* Hance, *Symplocos chunii* Merrill, *Schima superba* Gardner & Champion, *Cyclobalanopsis patelliformis* (Chun) Y. C. Hsu & H. W. Jen, *Vatica mangachapoi* Blanco, *Syzygium buxifolium* Hooker & Arnott, *Semiarundinaria shapoensis* McClure, *Licuala fordiana* Beccari, and *Ardisia densilepidotula* Merrill.

Distribution. *Hoya bawanglingensis* is only known from the type collection, which was found in a small

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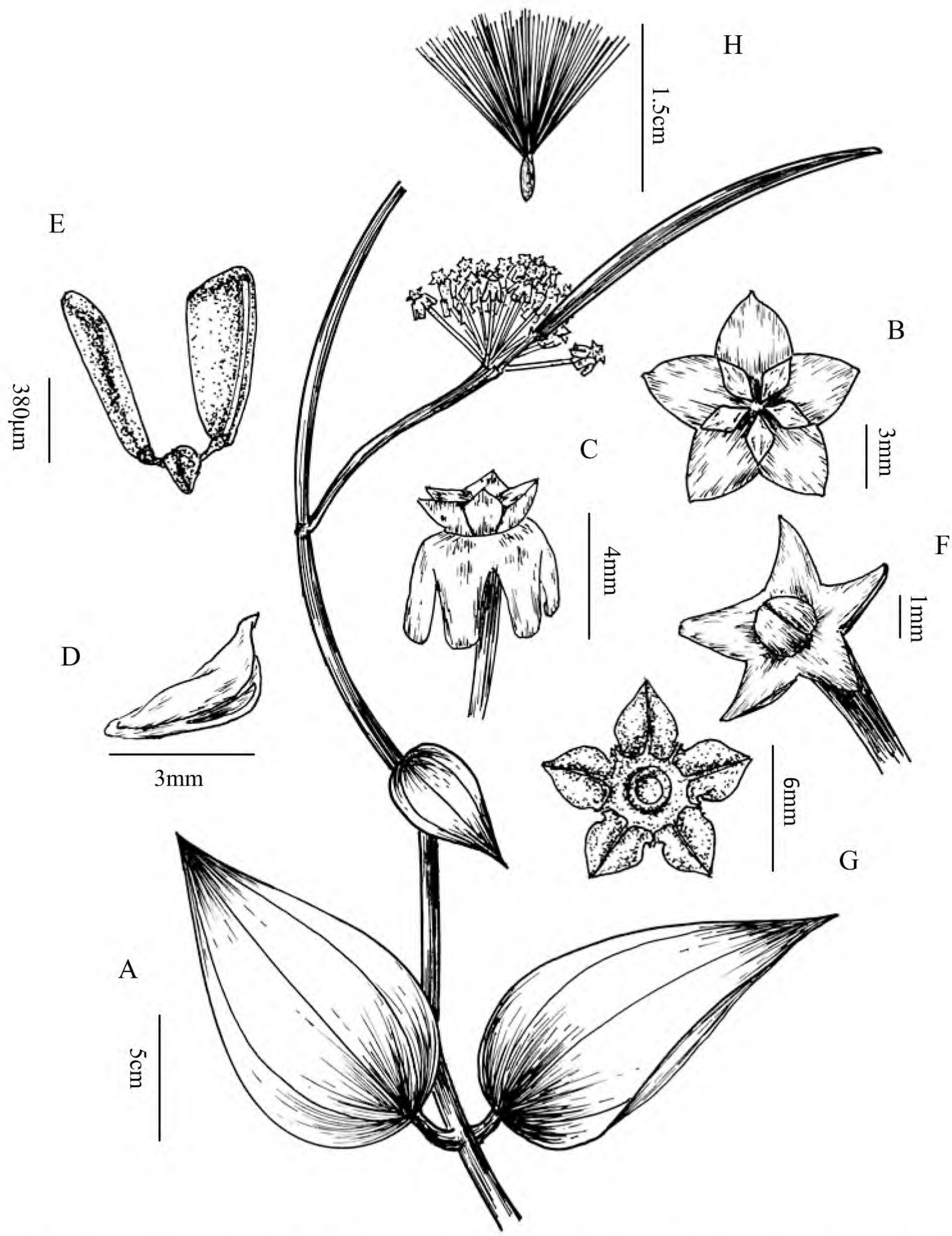

Figure 1. *Hoya bawanglingensis* S. Y. He & P. T. Li. —A. Flowering stem. —B. Flower. —C. Flower, side view. —D. Corona, side view. —E. Pollinarium. —F. Calyx and ovary. —G. Outer corona. —H. Seed and coma. Drawn from the holotype *He & Lin 0708081* (CANT).

area in Bawangling, Hainan Province, China. Other species of *Hoya* are found in the Bawangling area at altitudes from 270–1000 m.

IUCN Red List category. *Hoya bawanglingensis* is known only from Hainan. Despite its location in the Bawangling National Nature Reserve, its habitat has been degraded by deforestation resulting from human activities before the area was established as a nature reserve. The species is apparently rare and restricted in distribution, and is known only from one population with about 150 mature individuals. In addition to possible threats from unforeseen factors, *Hoya* has ornamental, medical, and economic value and is destructively collected in Hainan, which increases the risk of extinction. We therefore recommend that *H. bawanglingensis* be considered Vulnerable (VU C2b) according to IUCN Red List criteria (IUCN, 2001).

Table 1. Diagnostic characters of *Hoya bawanglingensis* and *H. pottsii*, two morphologically similar species.

Characters	*H. bawanglingensis*	*H. pottsii*
Young stem		
Indumentum	pubescent	glabrous
Color	purple spots	not described
Leaves		
Shape	ovate or elliptic	ovate-oblong to oblong-lanceolate
Apex	acuminate or acute	acute
Base	rounded or cordate	rounded or subcordate
Length (cm)	7.5–10.5	6–12
Width (cm)	3–4.5	3–6
Indumentum	pubescent on both surfaces, base margin pilose	glabrous on both surfaces, base margin glabrous
Color	green with purple maculae	not described
Basal veins	3	3
Petiole		
Indumentum	pubescent	glabrous
Color	dark purple or grayish green	not described
Flower		
Peduncle	pubescent	glabrous
Pedicels	pubescent	glabrous
Calyx outside	outside scabrous	outside glabrous
Corolla lobe color	white with purple spots	white
Corolla diameter (cm)	1	1
Corolla inside	white pilose	white pilose
Corona lobe color	white with purplish center	white with reddish center
Ovaries	purplish white	not described
Habitat	mountain forests, on trees, alt. 270–430 m	mountain forests, on trees, alt. below 500 m
Distribution	China: Bawangling, Hainan	China: Guangdong, Guangxi, Hainan, Yunnan

Phenology. The new species was observed to flower from mid-April to August, with fruiting from August to September.

Etymology. The specific epithet refers to Bawangling, Hainan Province, China, the area in which the holotype specimen was collected.

Discussion. *Hoya bawanglingensis* closely resembles *H. pottsii* Traill, which was described in 1830, and is also distributed in China. The two species are similar in the shape and size of the leaves and in the three basal leaf veins. However, the new species differs from *H. pottsii* in the pubescence of its stems, leaf blades on both surfaces, petiole, peduncles, pedicels, outer calyx lobes, and follicles. The stems are slender, and purple spots distinguish the stems, leaf blades, petioles, outer calyx lobes, corolla lobes, and ovaries. Morphological characters of the two species are compared in Table 1.

Paratypes. CHINA. **Hainan:** Bawangling, 19°07′N, 109°06′E, on tree in montane rainforest, 423 m, 8 Aug. 2007, *S. Y. He & J. Y. Lin 0708082, 0708083* (CANT).

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Brongniartia balsensis (Leguminosae, Papilionoideae), una Especie Nueva de la Depresión del Río Balsas, México

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Resumen. Se describe e ilustra a *Brongniartia balsensis* J. Jiménez Ramírez & K. Vega (Leguminosae, Papilionoideae), una especie nueva y endémica de la Depresión del Balsas. El nuevo taxón es similar a *B. guerrerensis* J. Jiménez Ramírez & J. L. Contreras, pero difiere de esta especie por tener un mayor número de folíolos y por presentar pedicelos, bractéolas, cáliz, estandarte, alas y quilla de mayor tamaño, además de tener diferencias en la forma del estandarte, el color de la quilla (verde) y poseer una legumbre ligeramente alada.

Abstract. *Brongniartia balsensis* J. Jiménez Ramírez & K. Vega (Leguminosae, Papilionoideae), a new and endemic species from the Balsas Depression, is described and illustrated. This species is similar to *B. guerrerensis* J. Jiménez Ramírez & J. L. Contreras, but differs from it by having a greater number of leaflets and larger pedicels, bracteoles, calyx, standard, wings, and keel; there are also differences in the form of the standard, the color of the keel (green), and the possession of a lightly winged legume.

Key words: Balsas Depression, *Brongniartia*, IUCN Red List, Leguminosae, Mexico, Papilionoideae.

El género *Brongniartia* Kunth con distribución desde Texas, México y Centroamérica hasta los Andes (McVaugh, 1987) incluye alrededor de 65 especies (Dorado, 1999; Dorado & Arias, 2006), casi todas endémicas de México.

Rydberg (1923) ubica a *Brongniartia* en la subtribu Brongniartianae, en tanto McVaugh (1987) la incluye en la tribu Brongniartieae. El género está constituido por árboles o arbustos con hojas imparipinnadas, estípulas pronto caedizas, flores generalmente axilares, solitarias o en grupos de dos a siete, o en racimos terminales o panículas, cáliz brevemente bilabiado con bractéolas, estandarte orbicular u obovado, el estambre superior libre, estilo filiforme, incurvado, fruto aplanado, en ocasiones con margen alado en la parte vexilar (McVaugh, 1987).

En el "Estudio florístico de la porción guerrerense de la cuenca del río Balsas", que se desarrolla en el Herbario de la Facultad de Ciencias (FCME), Universidad Nacional Autónoma de México (UNAM), se detectó una especie del género *Brongniartia* afín al grupo Sericeae de Rydberg (1923). Esta especie tiene parecido morfológico con *B. guerrerensis* J. Jiménez Ramírez & J. L. Contreras, que fue ubicada por Jiménez y Contreras (1989) en el grupo Sericeae de Rydberg (1923).

Brongniartia balsensis J. Jiménez Ramírez & K. Vega, sp. nov. TIPO: México. Guerrero: Mpio. Copalillo, 1 km antes de intersección entre el poblado y balneario de Papalutla, 30 abr. 2007, *J. Jiménez 1668* (holotipo, FCME; isotipos, MEXU, MO). Figura 1.

Haec species *Brongniartiae guerrerensi* J. Jiménez Ramírez & J. L. Contreras affinis, a qua imprimis cortice brunneo rubrove, stipulis oblongis, pedicello et calyce majoribus, vexillo orbiculari majore brunneo, carina viridi majore et legumine alato differt.

Arbustos (1–)3–3.5(–4.5) m de alto, generalmente con 3–12 ejes principales o árboles hasta 4 m; corteza

Figura 1. *Brongniartia balsensis* J. Jiménez Ramírez & K. Vega. —A. Rama con flores. —B. Cáliz y bractéolas. —C. Estandarte. —D. Ala. —E. Pétalo de la quilla. —F. Androceo. —G. Gineceo. —H. Fruto. —I. Folíolos maduros. —J. Estipelas. —K. Estípulas. —L. Hábito. —M. Corteza. (A–G y K, *Jiménez 1668*, FCME; H, *Vega 1105*, FCME; I, J, *Cruz et al. 7033*, FCME). Todas las escalas en centímetros.

café a rojiza con abundantes lenticelas blancas, exfoliante en grandes fragmentos (en individuos jóvenes la corteza es blanca y corchosa, generalmente en la parte basal del tallo); ramillas blanco-seríceas. Hojas (9–)12.5–16(–19) cm, imparipinnadas, con 11 a 15(17) folíolos; estípulas ca. 5 × 1.5 mm, oblongas, envés blanco-seríceo, pronto caedizas; pecíolos (1.3–) 1.5–3.3(–5) cm, blanco-seríceos; raquis seríceo; folíolos 2.4–3.5(–4) × 1.1–2(–2.3) cm, elípticos, pubescentes, blanco-seríceos cuando jóvenes, al madurar verdes en el haz, ápice con mucrón de hasta 1 mm, base obtusa, peciólulos 3–4 mm, blanco-seríceos; estipelas hasta 1 mm, seríceas en el envés, anaranjadas. Flores axilares, 2 por axila, opuestas (generalmente se fecunda una); pedicelos (1–)1.4–1.9(–2.6) cm, blanco-seríceos; cáliz 19.1–20.9 mm, blanco-seríceo, tubo 6.7–7.3 mm; bractéolas (2.5–)4–8.2 mm, filiformes, blanco-seríceas; corola marrón; estandarte marrón con mácula verde, 19.2–19.6 × 18.5–19.5 mm, orbicular, ápice emarginado con uña 3.4–3.7 mm, ala (21.5–)22.1 × (8.2–)9.1–11 mm con uña 3.5–4.4 mm, quilla verde, 21.8–23.2 × 9.4–11.1 mm, parte unida hasta 1/4 de su longitud, ca. 7.5 mm, uña 3.2–3.4 mm, presenta una aurícula en la base 2–3.1 mm, androceo ca. 22 mm, parte unida 15.5–17.4 mm; pistilo 26.1–26.7 mm, glabro, ovario 12–12.6 mm, óvulos 4 a 6, estilo 14–15.8 mm. Legumbre (5.5–) 6–6.7 × 1.8–2.2 cm, aplanada, sutura carinal en forma de ala de hasta 2 mm de ancho; semillas 4 a 5 por fruto.

Distribución. *Brongniartia balsensis* restringe su distribución a la porción oriental de la Depresión del Balsas en el estado de Guerrero, en altitudes de (699–) 762–809 m y solamente se conocen dos poblaciones, una en Papalutla de unos 100 individuos y otra en las cercanías de Tlalcozotitlán con unos 40 individuos, por ello es una especie en peligro crítico (Critically Endangered o CR), según los criterios de la UICN (2001).

Hábitat y fenología. Esta especie se presenta en bosque tropical caducifolio en laderas con substratos kársticos. Se le encuentra asociada a *Pseudosmodingium perniciosum* (Kunth) Engler, *Bursera* Jacquin ex L., *Plumeria rubra* L., *Neobuxbaumia* Backeberg, *Mimosa* L., *Croton* L., *Ceiba parvifolia* Rose, *Manihot* Miller, *Opuntia* Miller, *Cnidoscolus* Pohl, *Senna wislizeni* (A. Gray) H. S. Irwin & Barneby, *Dalembertia populifolia* Baillon, *Stemmadenia pubescens* Bentham, *Lonchocarpus* Kunth, *Jatropha elbae* J. Jiménez Ramírez, *Randia* L., *Acacia coulteri* Bentham y *Nissolia leiogyne* Sandwith. La floración se presenta desde finales de abril hasta mediados de mayo (aunque en un individuo, se formaron flores en fechas posteriores en algunas ramas donde se cortaron previamente, en el mes de abril, las ramillas para herborizar), mientras las hojas inician su desarrollo, en tanto que la fructificación ocurre de mayo a julio.

Etimología. El epíteto específico hace alusión a la depresión del Balsas, una zona rica en endemismos, en particular en la porción que incluye el estado de Guerrero.

Discusión. Las flores axilares, la pubescencia blanco-sericea abundante en las ramillas, los folíolos y el cáliz, los 11 a 15(17) folíolos elípticos y los frutos glabros y alados del nuevo taxón, conducen a ubicarlo en el grupo Sericeae de Rydberg (1923) que incluye a *Brongniartia argentea* Rydberg, *B. benthamiana* Hemsley, *B. lupinoides* (Kunth) Taubert, *B. magnibracteata* Schlechtendal, *B. mollis* Kunth, *B. pringlei* Rydberg, *B. sericea* Schlechtendal y a *B. vicioides* M. Martens & Galeotti, posteriormente Jiménez y Contreras (1989) agregan a *B. guerrerensis*. Sin embargo, McVaugh (1987) señala que existen problemas para delimitar a casi todas las especies del grupo, a excepción de *B. lupinoides*, aunque no menciona nada alrededor de *B. magnibracteata* y *B. mollis*, mientras que Calderón y Rzedowski (2001) apuntan que posiblemente *B. benthamiana* y *B. mollis* sean sinónimos de *B. intermedia* Moricand. A pesar de los problemas señalados, la especie nueva presenta una morfología muy diferente a las especies incluidas por Rydberg (1923) en el grupo Sericeae, pues ninguna de ellas, tiene corteza exfoliante como la que se presenta en muchas especies del género *Bursera*, asimismo carecen de hábito arbóreo en su madurez, de corcho en la base del tallo de las plántulas, de estípulas oblongas, de bractéolas filiformes y de flores color marrón. Aunque, es importante aclarar que *B. guerrerensis* fue incluida recientemente en el grupo Sericeae de Rydberg (1923), tiene corteza exfoliante y habito arbóreo, por lo que será examinada cuidadosamente en los párrafos siguientes.

En el género, solamente se han reportado seis especies arbóreas, *Brongniartia glabrata* Hooker & Arnold, *B. goldmanii* Rose, *B. guerrerensis*, *B. guiengolensis* Dorado & L. Torres, *B. montalvoana* Dorado & D. M. Arias y *B. parryi* Hemsley, de modo que *B. balsensis* es la séptima. Entre ellas, *B. guerrerensis* que tiene corteza exfoliante y corcho en sus ramas, fue ubicada en el grupo Sericeae de Rydberg (1923) por Jiménez y Contreras (1989), por presentar flores axilares, legumbre glabra, ramas, ramillas, folíolos (oblongo-ovados a elípticos) y cálices seríceos, por lo que su comparación con la especie nueva es ineludible, sobre todo porque sus folíolos son similares en el tamaño y forma, así como la de sus pecíolos y peciólulos. Sin embargo, *B. guerrerensis*

tiene corteza anaranjada que exfolia en tiras como en *Bursera schlechtendalii* Engler, estípulas lanceoladas de 2–4 mm, pecíolo de (0.8–)1.8–2.5(–3.1) cm, folíolos 5 a 11(13), (0.9–)2.3–3(–4.5) × (0.5–)1–2 (–3.6) cm, ovados, oblongo-ovados a elípticos, pedicelos 0.8–1.2 cm, bractéolas lanceoladas de 3–5 mm, cáliz de 1–1.5 cm, corola púrpura, estandarte ovado de ca. 15 mm, alas 10–11 mm, quilla púrpura de 11–13 mm, legumbre 6–8 × 2.5–3 cm, sin ala, en cambio, *B. balsensis* tiene corteza pardo-rojiza que exfolia en placas como en *B. papyracea* Dorado & D. M. Arias, estípulas oblongas de 5 mm, pecíolo (1.3–)1.5–3.3(–5) cm, folíolos 11 a 15(17), 2.4–3.5(–4) × 1.1–2(–2.3) cm, elípticos, pedicelos (1–)1.4–1.9(–2.6) cm, bractéolas filiformes de (2.5–)4–8.2 mm, cáliz 19.1–20.9 mm, corola marrón, estandarte orbicular de 19.2–19.6 mm, alas (21.5–)22.1 mm, quilla verde de 21.8–23.2 mm y legumbre (5.5–)6–6.7 × 1.8–2.2 cm, con un ala. Es evidente que difieren en el color de la corteza y en el número de folíolos (a pesar de un pequeño traslape), en el tamaño de pedicelos, bractéolas, cáliz, estandarte, alas y quilla, sin olvidar las diferencias en la forma del estandarte, en el color de la quilla y en la legumbre (una especie con ala y otra carente de ella). Además, el período de floración de ambas especies es diferente, *B. guerrerensis* tiene flores en julio mientras que *B. balsensis* las presenta a finales de abril y en la primera mitad de mayo. El punto no deja de ser importante porque ambas especies se han hallado en localidades cercanas (Tlalcozotitlán, Guerrero), sin embargo, la especie nueva solamente se halla en calizas rosadas y la otra especie parece no tener una afinidad tan específica a un sustrato determinado.

Brongniartia papyracea es la tercera especie del género que presenta tallos exfoliantes, pero se trata de un arbusto de 1–4 m de alto, con corcho en las ramas, que pertenece al grupo Podalyrioides de Rydberg (1923) de acuerdo con Dorado y Arias (2006), por tener estípulas hemicordadas o cordadas y bractéolas lineares y diminutas, por lo que aparentemente no tiene relación cercana con la especie nueva.

Paratipos. MEXICO. **Guerrero:** Mpio. Copalillo, 1 km antes de intersección entre el poblado y balneario de Papalutla, *J. Jiménez 1669, 1670, 1671, 1672, 1673, 1674* (FCME), *K. Vega 1104, 1105, 1106, 1114, 1115, 1116, 1117, 1138, 1139, 1140* (FCME); Papalutla, 1.8 km al NO, *R. Cruz, C. Fuentes, L. Céspedes y O. Sánchez 6889, 6891, 6898* (FCME); Atcingo, 1 km al SE, *R. Cruz, C. Fuentes, L. Céspedes y O. Sánchez 7033, 7035* (FCME).

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Nomenclatural Notes on *Callitriche* (Callitrichaceae) in North America

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Abstract. Taxonomic review is provided for taxa of *Callitriche* L. (Callitrichaceae) occurring in North America. One new species, *C. stenoptera* Lansdown, is described from Arizona in the United States, and the following names are lectotypified: *C. anceps* Fernald, *C. drummondii* Hegelmaier, *C. hermaphroditica* L. var. *bicarpellaris* (Fenley ex Jepson) H. Mason, *C. longipedunculata* Morong, *C. marginata* Torrey, *C. nuttallii* Torrey, *C. sepulta* S. Watson, and *C. stenocarpa* Hegelmaier.

Key words: Callitrichaceae, *Callitriche*, North America.

Taxa in *Callitriche* L. (Callitrichaceae) are monoecious, or in a single case (*C. petriei* R. Mason subsp. *petriei*), dioecious, the flowers are axillary and usually solitary, but may occur in various combinations in the same axil; the perianth is absent, but a subtending pair of bracts may be present in some species. The fruits are schizocarps, separating into four mericarps that are dry, winged or not, with wings from the inner fruit layer. Due to their small size and reduced nature, it can be difficult to find reliable characters by which to distinguish *Callitriche* taxa. The presence or absence of a wing on the outer margins of the fruit is the most important character used both taxonomically and in identification. Work on the European members of the genus (e.g., Schotsman, 1967; Lansdown, 2006) has shown that while the outer layer of cells may at times resemble a wing, the wing is actually formed of processes arising from the testa; these processes usually define the walls of cells and may be linked to complex fibrils crossing the faces of the cells (Lansdown, 2008). The wing has played such a significant role in *Callitriche* taxonomy that a number of taxa, such as the subspecies of *C. truncata* Gussone, are defined largely by the presence or absence of a wing. As employed here, therefore, the term wing applies only to a structure arising from and of a clearly different structure to the testa.

Taxonomic work on North American *Callitriche* has been based almost exclusively on herbarium material. The study of dried fruit in *Callitriche* is complicated, at least in part, because of the response of fruit to preparation as herbarium specimens. Immature fruit are usually soft and tend to compress, and there is a stage at which fruit that have reached their full size but not hardened will distort on pressing and appear larger than mature fruit. In most cases, this distortion also makes it impossible to study details of the wing. In addition, until fruit are absolutely mature, the drying process can make up to quite a broad band of marginal cells appear translucent in contrast to the cells of the testa and can give the appearance of a wing. A further problem arises when fresh fruits are swollen (as is the case in *C. peploides* Nuttall), but this is reduced on drying to a strumose base to each mericarp. Dried material of *C. peploides* var. *peploides* can resemble *C. palustris* L., but the confusion would be unlikely to occur in relation to fresh material as the latter does not have swollen fruit. The styles and bracts associated with immature fruit are fragile and, depending on the quality of pressing and the age and degree of use of a specimen, can either remain attached or be lost, making it difficult to establish whether or not these characters are naturally persistent or caducous. Most herbarium specimens of *Callitriche* worldwide, not just in North America, are more than 100 years old and few are in good enough condition to provide reliable taxonomic data.

In preparing the treatment of *Callitriche* for the *Flora of North America*, more than 1000 herbarium specimens were studied from an area in the Americas extending from Alaska east to Greenland and south to Mexico from the following herbaria: ALA, BM, F, JEPS, K, LE, MICH, MO, ORE, PE, TAMU, UBC, UC, V, and WTU. Fresh material from 103 live populations of 12 taxa was studied in Alaska, California, Missouri, Oregon, Texas, Washington, and British Columbia. All descriptive and biometric data employed here are based on specimens collected in North America. One new species was identified: *C. stenoptera* Lansdown, occurring in the western United States and throughout southern Canada, but previously overlooked as *C. hermaphroditica* L.

Key to the *Callitriche* Species Found in North America

1a. Fruit unwinged, i.e., lacking processes arising from the testa 2
1b. Fruit winged, even if only narrowly at the apex. . . . 5

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2a. Mericarps swollen or (in dried material) with the bases swollen at the point where they meet, such that there is no evident flat face . . . *C. peploides* Nuttall
2b. Mericarps without swollen bases, at least one face ± flat 3
3a. Fruits longer than wide; mericarps not divergent at apex . . . . . *C. palustris* L.
3b. Fruits as wide as or wider than long; mericarps divergent at apex 4
4a. Fruits (0.6–)0.7–0.8(–1) mm wide . . . . . *C. heterophylla* Pursh var. *heterophylla*
4b. Fruits (0.8–)0.9–1.1(–1.2) mm wide . . . . . *C. heterophylla* Pursh var. *bolanderi* . . . . . (Hegelmaier) Fassett
5a. Fruit winged only at apex 6
5b. Fruit winged throughout. 9
6a. Fruits pedunculate with peduncles ± 0.2 mm long; fruits much wider than long . . . *C. terrestris* Rafinesque
6b. Fruits sessile or subsessile; fruits longer than or as long as wide 7
7a. Fruits longer than wide; mericarps not divergent at apex . . . . . *C. palustris* L.
7b. Fruits as wide as or wider than long; mericarps divergent at apex 8
8a. Fruits (0.6–)0.7–0.8(–1) mm wide . . . . . *C. heterophylla* Pursh var. *heterophylla*
8b. Fruits (0.8–)0.9–1.1(–1.2) mm wide . . . . . *C. heterophylla* Pursh var. *bolanderi* . . . . . (Hegelmaier) Fassett
9a. Leaf bases not joined; pollen and anthers translucent or appearing pale; no peltate scales on stem and leaves; bracts absent; leaves with a primary vein but without secondary veins 10
9b. Leaf bases joined by a ridge of tissue extending across the node; pollen and anthers yellow or translucent; peltate scales on stem and leaves; bracts present or caducous; leaves with a primary vein and often with secondary veins 12
10a. Wing narrower than seed width. . . *C. stenoptera* Lansdown
10b. Wing as wide as or wider than seed width 11
11a. Fruit pedunculate, wider than long . . . . . *C. fassettii* Schotsman
11b. Fruit sessile, as wide as long . . . *C. hermaphroditica* L.
12a. At least some fruit on peduncles > 2 mm long. . . 13
12b. Fruit sessile or on peduncles < 2 mm long 15
13a. Fruits longer than wide; bracts present; most filaments > 2 mm long . . . *C. longipedunculata* Morong
13b. Fruits wider than long; bracts lacking; filaments < 1 mm long. 14
14a. Fruits appearing flat-ended because wing curved outward, with no notch between the margins of the mericarps . . . . . *C. nuttallii* Torrey
14b. Fruits with a distinct notch between the margins of the mericarps. . . . . *C. marginata* Torrey
15a. Stigma 1.5–4.5 mm long, reflexed and appressed to side of fruit; pollen (and therefore anthers) colorless . . . . . *C. brutia* Petagna var. *hamulata* . . . . . (Kützing ex W. D. J. Koch) Lansdown
15b. Stigma erect or if reflexed, then < 1 mm, not appressed to side of fruit; pollen (and therefore anthers) yellow. 16
16a. Fruit < 1 mm long, wider than long . . . . . *C. terrestris* Rafinesque
16b. Fruit > 1 mm long, ± as wide as long 17
17a. Ripe fruit brown or grayish brown; bracts persistent; wing wide. . . . . *C. stagnalis* Scopoli
17b. Ripe fruit blackish; bracts caducous; wing narrow. . . . . *C. trochlearis* Fassett

1. Callitriche anceps Fernald, Rhodora 10: 51. 1908. TYPE: Canada. [Quebec:] W base of Table-topped Mtn., "Lac des Americains," 670 m, 1 Aug. 1906, *M. L. Fernald & J. F. Collins 234* (lectotype, designated here, GH 48916; isotypes, K, NY 248728, NY 248729, US 60607). EPITYPE: Canada. "Stranded 3 dm above water, margin of the uppermost lake at head of E Fork of R. Ste. Anne des Monts," 1050 m, 8 Aug. 1906, *M. L. Fernald & J. F. Collins 638* (epitype, designated here, GH 48916).

Fernald cited *Fernald & Collins 234*, from "Lac des Americains, western base of Table-topped Mountain, 1 August 1906," as the type of his name *Callitriche anceps*. I have seen five sheets holding part of this collection and none has any mature fruit. Similarly, the scanned image of the type material in US clearly shows very small plants lacking mature fruit, although there may be mature material in the packet. Included on the holotype sheet GH 48916 as well as type material of *C. anceps*, there is material from two other collections: *Fernald & Collins 637* that also bears no mature fruit and *Fernald & Collins 638* that has mature fruits. This material was evidently considered by Fernald to be of the same taxon as the type material of *C. anceps* and agrees with the concept of *C. anceps* Fernald given by Fassett (1951: 187) and as applied by most American authors. Therefore, although it will not be possible to clarify the taxonomic status of *C. anceps* without detailed study of live populations, I have designated *Fernald & Collins 638* at GH as an epitype because of the representative presence of mature fruits.

2. Callitriche fassettii Schotsman, Acta Bot. Neerl. 15: 477. 1966. TYPE: U.S.A. Oregon: "in small ponds near Dalles City, Oregon," 4 May 1898, *W. M. Suksdorf 2746* (holotype, L 910185605 not seen; isotypes, DS not seen, GH, MO, US not seen, WTU).

Callitriche hermaphroditica L. var. *bicarpellaris* (Fenley ex Jepson) H. Mason, Fl. Marshes Calif.: 557. 1957, syn. nov. *C. autumnalis* L. var. *bicarpellaris* Fenley ex Jepson, Fl. Calif. 2: 436. 1936. TYPE: U.S.A. California: San Joaquin Co., 4 mi. N of Clementes, 3 May 1928, *H. Mason 4445* (lectotype, designated here, UC 570781; isotype, GH 48919).

Callitriche autumnalis var. *bicarpellaris* was described by Jepson in 1936 (based on an unpublished manuscript account of 1932 by Kittie Fenley), who cited three collections from California, the type as cited above and two that Fenley collected herself west

of Santa Rosa (*Fenley 561* and *562*). Apparently unfamiliar with this material, in 1966 Schotsman named *C. fassettii* based on material from pools near The Dalles, on the northern border of Oregon. Comparison of material from both types shows clearly that *C. autumnalis* var. *bicarpellaris* and *C. fassettii* represent the same taxon and that although they are closely related to *C. hermaphroditica* L., they also show consistent and striking differences from it. Inaccurately listed as a synonym of *C. hermaphroditica* in Lansdown (2006), the name *C. fassettii* is retained for this taxon and the name *C. autumnalis* var. *bicarpellaris* is reduced to synonymy of this name.

3. Callitriche longipedunculata Morong, Bull. Torrey Bot. Club 18: 236. 1891. TYPE: U.S.A. California: San Diego, Mesas, 8 May 1884, *C. R. Orcutt s.n.* (lectotype, designated here, NY 248733 [3 of the 4 specimens, the 2 upper and 1 left-hand of the lower specimens on sheet]).

Callitriche longipedunculata was described by Thomas Morong (1891) based on material sent to him by C. R. Orcutt. The letter written in response to receipt of the material is included with the isotype in UC. In it, Morong states "It is not *C. marginata* Torrey, which is a very different species, but one not hitherto described and which I have named *C. longipedunculata* and expect soon to publish under that name. Its nearest ally is *C. muscoides* Goldbach found at Constantinople. I return by mail the specimen and label as you desired." However, the UC material is entirely composed of *C. marginata* Torrey. Similarly, a sheet in US bears the note "This is not *C. marginata* Torrey but an undescribed species which I have named, M," which I presume to be by Morong; however, this, too, is entirely composed of *C. marginata* Torrey. The only one of eight isotypes of *C. longipedunculata* cited by Morong in 1891 that includes any of that species as it is currently interpreted is NY 248733, which bears three collections of *C. longipedunculata* and one of *C. marginata*. In consideration of the mixed status of the type, according to Articles 9.2 and 9.12 of the *International Code of Botanical Nomenclature* (ICBN; McNeill et al., 2006), I therefore designate above three of the four samples of this species on this sheet as the lectotype.

4. Callitriche marginata Torrey, Pacific Railr. Rep. 4(5): 135. 1857. TYPE: U.S.A. [California:] Sonoma Co., "muddy places along Mark West's Creek," 30 Apr. 1854, *J. M. Bigelow s.n.* (lectotype, designated here, MO 1913618; isotypes, GH, K, NY, STU not seen, US not seen).

Callitriche sepulta S. Watson, Proc. Amer. Acad. Arts 14: 298. 1879, syn. nov. TYPE: U.S.A. Oregon: s.d., *E. Hall 459* (lectotype, designated here, MO 1913631; isotypes, NY 248740, NY 248741).

Most sheets representing parts of the type of *Callitriche marginata* have parts of two collections mounted on them, one by Bigelow from "muddy places along Mark West's Creek, California" with a printed label saying "Lieut. A. W. Whipple's Exploration for a Railway Route, from the Mississippi River to the Pacific Ocean, near the 35th parallel of latitude in 1853–4. Collected by Dr. J. M. Bigelow, Surgeon and botanist to the expedition," the other simply labeled "Rev. Mr. Fitch, California." Torrey (1857) cited "Muddy places along Mark West's creek, California; April 30. Upper California; Rev. A. Fitch," combining text from both collections and causing confusion. The MO 1913618 sheet is a mixed specimen that includes material collected by Fitch that is ex. herb. Torrey as well as material collected by J. M. Bigelow annotated "co-type" by N. C. Fassett. According to Art. 9.12 of the ICBN (McNeill et al., 2006), the material collected by J. M. Bigelow on sheet MO 1913618 is designated here as the lectotype.

5. Callitriche nuttallii Torrey, Pacific Railr. Rep. 4(5): 135. 1857. Replaced name: *Callitriche pedunculosa* Nuttall, Trans. Amer. Philos. Soc., ser. 2, 5: 140. [Jan.] 1835, non *Callitriche pedunculata* DC., 1805. TYPE: U.S.A. Louisiana: s.d., *J. Hale s.n.* (lectotype, designated here, NY 465074; isotypes, GH 219782, MO 1913611, NY 465070).

From his description, it is clear that by his *Callitriche pedunculosa*, Nuttall intended a terrestrial *Callitriche* with pedunculate fruit that occurred in Arkansas. This could equally refer to *C. terrestris* Rafinesque, which is more abundant and widespread than *C. nuttallii* Torrey in the state. Nuttall (1835) did not list any specimens in his description, nor did Torrey (1857). Hegelmaier (1867) listed "Arkansas, Nuttall 1835; Louisiana, J. Hale, comm. Engelm.," the former not associated with any specimen that I have been able to locate, but the latter represented by specimens in GH, MO, and NY. Of these specimens, only NY 465074 is not part of a mixed collection and includes "Louisiana" and "J. Hale" on the label. The lectotype chosen above maintains *C. nuttallii* in its current interpretation.

Torrey (1857) described *Callitriche marginata* as "A well characterized species, resembling *C. nuttallii*; nob. [us, presumably referring to himself and Nuttall] (*C. pedunculosa*, Nutt. in Trans. Amer. Phil. Soc. n. ser. 5, p. 140; not of Arnott, nor *C. pedunculata* DC.)."

He correctly considered *C. pedunculosa* to be a homonym of *C. pedunculata* DC.

6. Callitriche palustris L., Sp. Pl. 2: 969. 1753. TYPE: [Europe.] "Habitat in Europae fossis paludibus" (lectotype, designated by Lansdown & Jarvis, 2004: 169, LINN 13.1 [lowermost 3 specimens on sheet]).

Callitriche stenocarpa Hegelmaier, Verh. Bot. Ver. Prov. Brandenburg 10: 114, 1868, syn. nov. *Callitriche palustris* var. *stenocarpa* (Hegelmaier) Jepson, Man. Fl. Pl. Calif. (Jepson) 1925, syn. nov. TYPE: U.S.A. California: San Mateo Co., Searsville, 1864, *H. N. Bolander 78* (lectotype, designated here, MO 1913617; isotype, GH 48922).

Callitriche palustris var. *verna* (L.) Fenley ex Jepson, Fl. Calif. 2: 435. 1936, syn. nov. Basionym: *Callitriche verna* L., Fl. Suec. (ed. 2): 2 [Oct.] 1755. TYPE: [Europe.] (lectotype, designated by Lansdown & Jarvis, 2004: 171, LINN 13.2).

Fassett (1951: 210) stated that "Individuals with fruits nearly sessile or with some of them so have been treated as *Callitriche stenocarpa* Hegelm." and noted that the two collections cited by Hegelmaier (1868) represent "a sorry mixture of *C. verna*, *C. heterophylla*, and *C. marginata*." Fassett went on to assign *C. stenocarpa* to the synonymy of *C. verna* (= *C. palustris* L.). Hegelmaier (1868: 114) had earlier referred to two collections in relation to this name. The first is the type material cited above for *C. stenocarpa* and the second collection was listed as "Russian River, Ukiah, *Bolander 3870*," which I have not seen. *Bolander 78* is a mixed collection, accurately identified by N. C. Fassett (1951: 210) as including *C. palustris* (as "*C. verna* L. emend. Kütz." and "*C. palustris* Am. Auct."), *C. heterophylla*, and *C. marginata*, as well as fragments of *Ranunculus* L. The different taxa cannot be separated, being in a single mass, but *C. palustris* represents the majority of the collection and I therefore designate this material as the lectotype for the name *C. stenocarpa* Hegelmaier, reducing it to synonymy with *C. palustris* L.

7. Callitriche peploides Nuttall, Trans. Amer. Philos. Soc., n.s. 5: 141. 1835. TYPE: U.S.A. Arkansas: s.d., *T. Nuttall s.n.* (lectotype, designated by Lansdown, 2006: 115, NY 248737).

7a. Callitriche peploides Nuttall var. **peploides**.

Callitriche drummondii Hegelmaier, Monogr. Callitriche 60. 1864. TYPE: U.S.A. Louisiana: Orleans Parish, New Orleans, [1832], *T. Drummond s.n.* (lectotype, designated here, NY 248737; isotypes, GH 48917, GH 48918).

Specimens of *Callitriche peploides* by Drummond labeled New Orleans appear to be represented by three collections: one unnumbered, one numbered 115 (and dated 1832), and the other numbered 108. In his account of *C. drummondii*, Hegelmaier did not cite a collection number, and therefore I interpret the type as being only those sheets without a collection number. The GH sheet has material from more than one collection of the same taxon, and I have designated the NY material as the lectotype accordingly.

Two additional varieties were described by Fassett (1951) for *Callitriche peploides*, with variety *media* and variety *semialata* from Guatemala and Mexico, respectively. Neither taxon occurs in the North American flora.

8. Callitriche stenoptera Lansdown, sp. nov. TYPE: U.S.A. Arizona: Apache Co., Mexican Hay Lake, 6 mi. S of AZ 260 along AZ 273 on the N side of the rd., Eager Quad, R28E, T7N, sec. 2, 8890 ft., 22 Sep. 1984, *J. Ricketson 2106* (holotype, MO 3834806). Figure 1.

Ab omnibus *Callitriches* L. speciebus borealiamericanis, *C. hermaphroditica* L. et *C. fassettii* Schotsman exceptis, foliis uninerviis, caule et foliis esquamtis et polline diaphano, a *C. hermaphroditica* et *C. fassettii* fructu maturo peranguste alato differt.

Flowering plants submerged. White stems contrasting strongly with dark green of leaves. Internodes decreasing gradually from base to apex, nodes bearing flowers with short internodes appearing congested. Leaves ± lingulate, 5.9–11.3 × 0.3–1.1 mm; all leaves with only 1 central vein. Flowers usually solitary or 1 pistillate and 1 staminate flower or occasionally 2 pistillate flowers in an axil; bracts absent. Filaments very short, up to 0.2 mm, ± straight; anthers ca. 0.2 × 0.2 mm; pollen colorless; styles reflexed or strongly curved downward, eventually broken off and the stump arising below the fruit apex and appressed to the side of the fruit, 0.6–1 mm. Fruits 0.8–1.2 × 0.9–1.3 mm, as long as or slightly narrower than wide, grayish brown; subsessile or on peduncle < 1 mm; wing narrow, up to 0.1 mm at the apex and side.

Distribution and habitat. *Callitriche stenoptera* occurs in Alaska, in Canada from British Columbia to Ontario and Newfoundland, from Oregon and the central states from Montana south to Arizona and east to New Mexico and north to Minnesota, but with no records known from the Dakotas.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), *Callitriche stenoptera* should be classified as Least Concern (LC).

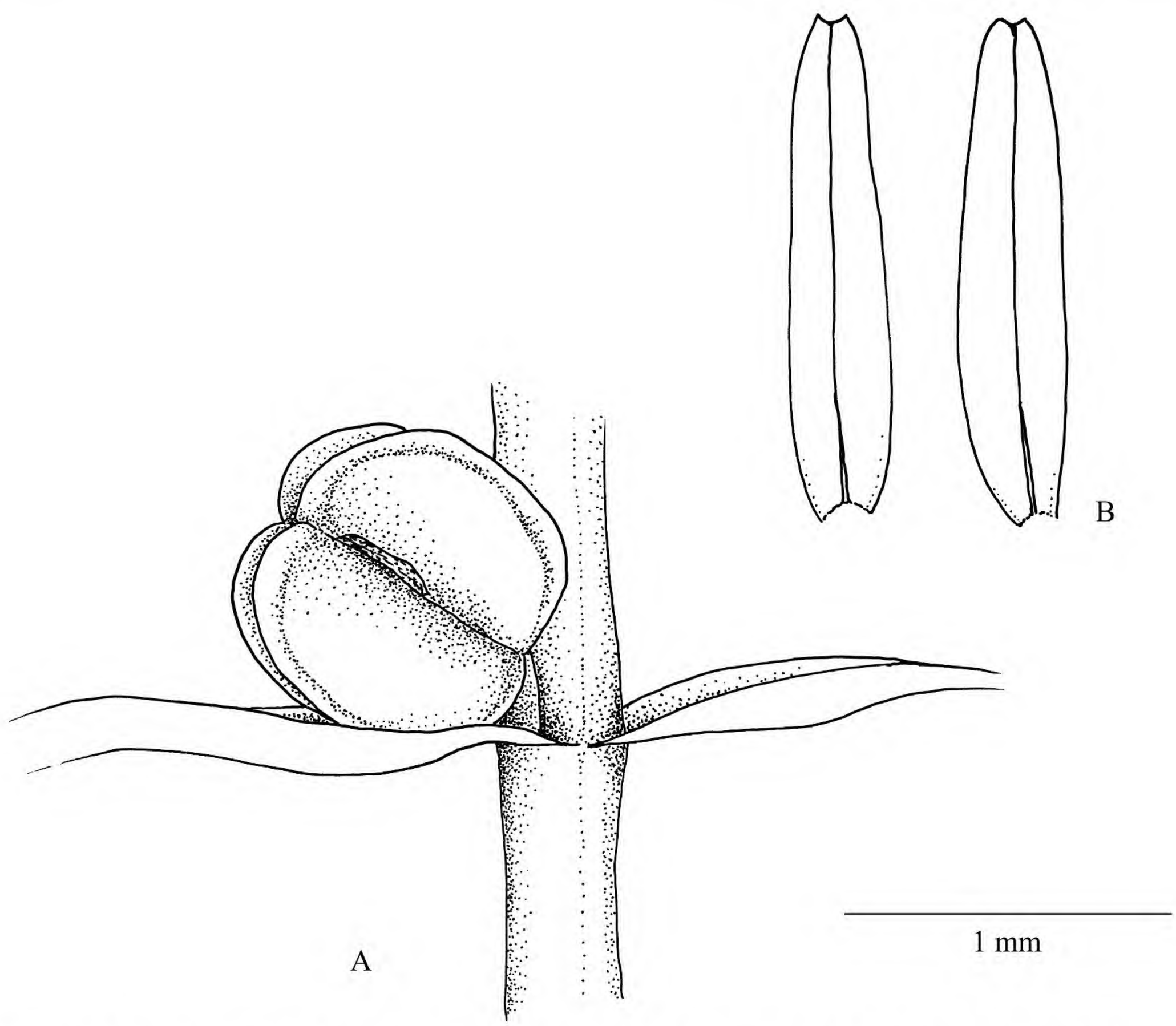

Figure 1. *Callitriche stenoptera* Lansdown. —A. Fruit. —B. Leaves. Drawn from the holotype, *J. Ricketson 2106* (MO).

Etymology. The epithet *stenoptera* (from the Greek "stenos," meaning "narrow," and "pteron," meaning "wing") refers to the narrower wing compared to that of similar species, i.e., *Callitriche hermaphroditica* and *C. fassettii.*

Discussion. *Callitriche stenoptera* can be distinguished from all species of *Callitriche* in North America except *C. hermaphroditica* and *C. fassettii* by the colorless pollen and the lack of scales on the stem and leaves, combined with all the leaves being single-veined, relatively uniform in shape, and often tapering from the base (Fig. 1). The new species can be distinguished from *C. hermaphroditica* and *C. fassettii* by the fruit on which the wing is less than 0.1 mm wide, even at the fruit apex. The fibrils of *C. stenoptera* in no way resemble those of *C. hermaphroditica* or *C. fassettii*, being extremely simple.

Paratypes. S. loc., s.d., *G. W. Clinton s.n.* (BM). CANADA. **Alberta:** S of Calgary, 1941, *C. L. Hitchcock & J. S. Martin 7832* (MO); Mannville, 1927, *E. H. Moss 1567* (K). **British Columbia:** Lake Sumass, 1958, *D. Lyall s.n.* (K). **Manitoba:** White Mud River, 1895, *J. Macoun 10594* (K). **Newfoundland:** East Brook, St. Barbe Bay, 1925, *K. M. Wiegand & N. Hotchkiss 28643* (K); Bay of Islands, 1896, *A. C. Waghorne s.n.* (MO). **Ontario:** Lake of the Woods, Kenoa, 1924, *A. B. Rendle & R. d'Oyley Good s.n.* (BM); s. loc., 1879, *J. Macoun 1287* (K); O'Sullivan Lake, Geraldton, Thunder Bay District, 1954, *W. K. W. Baldwin 6149* (K). **Saskatchewan:** Maple Creek, 1947, *A. J. Breitung 4882* (MO). U.S.A. **Alaska:** Kotzebue-Kobuk Lowland, 1960, s. coll. (UAM). **Colorado:** Rocky Mtns., s.d., *G. Vasey s.n.* (MO). **Idaho:** Near Thompson Mtn., 1895, *J. B. Leiberg 1604* (K, MO). **Minnesota:** Wheaton, Traverse, 1893, *E. P. Sheldon s.n.* (BM). **Montana:** 1905, *J. W. Blankinship s.n.* (BM); Helena, 1892, *E. Starz s.n.* (MO); Charlo, Flathead Co., 1934, *C. L. Hitchcock 2487* (MO); Missoula Co., Missoula, 1937, *F. A. Barkley & J. Kramer 1917* (MO). **Nebraska:** Pinoes Spring, 1853, *F. V. Hayden s.n.* (MO). **New Mexico:** Bitter Creek, Taos Co., 1969, *D. S. Correll & H. B. Correll 37601* (MO). **Oregon:** Rocky Mtns., 1845, *C. A. Geyer 6226* (K); Harney Valley, 1885, *T. J. Howell s.n.* (K); s. loc., 1927, *M. E. Peck 15743* (K); Flathead River, s.d., *C. A. Geyer s.n.* (K); Deschutes River, 1981, *Halse 2401* (MO). **Utah:** Brighton, 1898, *M. E. Jones 6356* (BM, MO); Fish Lake, 1894, *M. E. Jones 5781* (BM, MO); Wasatch Plateau, E of Salina, 1980,

B. Albee 4887 (MO); Clayton Peak, Wasatch Mtns., 1903, *S. G. Stokes s.n.* (MO). **Wyoming:** Kendall, Sublette Co., 1922, *E. B. Payson & L. E. B. Payson 2933* (MO).

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Aristolochia wuana, a New Name in Chinese *Aristolochia* (Aristolochiaceae)

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Abstract. A new name, *Aristolochia wuana* Zhen W. Liu & Y. F. Deng, is proposed to replace the later homonym *Aristolochia macrocarpa* C. Y. Wu & S. K. Wu ex D. D. Tao, not *A. macrocarpa* Duchartre. The species may be closely related to *A. griffithii* Hooker f. & Thomson ex Duchartre but differs in its retuse or rounded leaf apex (vs. acute or shortly acuminate), oblong capsule (vs. narrowly cylindrical), and the smooth upper surface of the seeds (vs. rugose).

Key words: *Aristolochia*, Aristolochiaceae, China.

In 1983, a new species of *Aristolochia* L. (Aristolochiaceae) was described from Xizang, China, as *A. macrocarpa* C. Y. Wu & S. K. Wu ex D. D. Tao (Tao, 1983). The species did not appear in the recently published Volume 5 of *Flora of China* (Huang et al., 2003). Furthermore, this name is a later homonym of *A. macrocarpa* Duchartre from West Africa (Duchartre, 1864; Ma, 1992). After studying the specimens of both *A. macrocarpa* Duchartre and *A. macrocarpa* C. Y. Wu & S. K. Wu ex D. D. Tao, it was apparent that the specimens represent two distinct species. According to the classification of Schmidt (1935) and Gonzalez (1999), *A. macrocarpa* Duchartre belongs to subgenus *Pararistolochia* (Hutchinson & Dalziel) O. C. Schmidt and *A. macrocarpa* C. Y. Wu & S. K. Wu ex D. D. Tao belongs to subgenus *Siphisia* (Rafinesque) Duchartre. Subgenus *Siphisia* differs from subgenus *Pararistolochia* in having six anthers (vs. eight to 10), a 3-lobed gymnostemium (vs. 8- to 10-lobed), and fruit flesh that is dehiscent (vs. woody indehiscent). Subgenera *Siphisia* and *Pararistolochia* were treated at generic rank as *Isotrema* Rafinesque and *Pararistolochia* Hutchinson & Dalziel, respectively, by some authors (Klotzsh, 1859; Huber, 1960, 1985, 1993; Poncy, 1978; Mabberley, 1987). However, the broad circumscription of *Aristolochia* was widely accepted by others (Hou, 1984; Phuphathanaphong, 1985; Hwang, 1988; Ma, 1989, 1992; Gonzalez, 1999; Murata et al., 2001; Huang et al., 2003) and supported by recent molecular studies (Wanke et al., 2006). According to Article 53.1 of the *International Code of Botanical Nomenclature* (McNeil et al., 2006), *A. macrocarpa* C. Y. Wu & S. K. Wu ex D. D. Tao must be replaced, and the following new name is proposed here.

Aristolochia wuana Zhen W. Liu & Y. F. Deng, nom. nov. Replaced name: *Aristolochia macrocarpa* C. Y. Wu & S. K. Wu ex D. D. Tao, Fl. Xizang. 1: 585. 1983, non *Aristolochia macrocarpa* Duchartre, 1864. TYPE: China. Xizang Autonomous Region: Zayü Xian, in woods, 2100 m, 1 Aug. 1973, *Qinghai-Xizang (Tibet) Complex Expedition 73-948* (holotype, KUN).

The species has not yet been described in English. The emended full description is provided as follows.

Shrub climbing; stems terete, striate, sparsely gray villous; buds densely grayish brown villous. Petioles 8–18 cm, sparsely gray villous; leaf blade cordate, 18–24 × 16–20 cm, thick papery, adaxially sparsely pubescent along the veins, abaxially reddish brown or white villous, basally palmate, with primary veins 3 to 5, lateral veins in 3 to 4 pairs, tertiary veins prominent abaxially, base cordate to auriculate, margin entire, apex retuse or rounded. Flowers not seen; pedicels 6–7 cm in fruit. Capsule solitary, oblong, ca. 11 × 6 cm,

6-ribbed, dehiscing at tip; seeds ovoid, upper surface plano-convex, smooth, lower surface deeply concave.

Distribution and habitat. *Aristolochia wuana* is known from northern Gaoligong Shan, occurring in southeastern Xizang and northeastern Yunnan in China. The plants were noted from mixed conifer and broad-leaved forest at altitudes from 2000 to 2300 m.

Phenology. The species has been collected in fruit from August to September. No flowering specimens have been seen.

Etymology. The species epithet honors Wu Zhengyi (Wu Chengyih) (13 June 1916–) of the Kunming Institute of Botany, Chinese Academy of Sciences, who first found *Aristolochia wuana* during the expedition to Qinghai-Xizang Plateau led by him in 1970–80s. Prof. Wu is a great expert on the flora of China and has devoted 70 years to the study of the flora and vegetation of China. He has organized several large-scale surveys of plant resources in southwestern China. He is currently the co-chair of the editorial committee of the *Flora of China*, a joint project between the Chinese Academy of Sciences and Missouri Botanical Garden that aims to revise the Chinese vascular plants. In 2007, he won the State Preeminent Science and Technology Award of China for his outstanding achievements in the fields of systematic botany and plant geography, as well as plant diversity, conservation, and sustainable use of plant resources.

Relationships. In the protologue, *Aristolochia wuana* was regarded as similar to *A. moupinensis* Franchet, differing in its leaves 18–24 × 16–20 cm (vs. 6–16 × 5–12 cm), retuse apex (vs. acute or acuminate), and larger fruits ca. 11 × 6 cm (vs. 6–8 × 2–3.5 cm) (Tao, 1983; Huang et al., 2003). Ma (1989) placed *A. macrocarpa* C. Y. Wu & S. K. Wu ex D. D. Tao in synonymy with *A. griffithii* Hooker f. & Thomson ex Duchartre. In fact, it differs from the latter in its retuse or rounded leaf apex (vs. acute or shortly acuminate), oblong capsule (vs. narrowly cylindrical), and the smooth upper surface of the seeds (vs. rugose).

Additional specimens examined. CHINA. **Xizang:** Mêdog Xian, near Beibeng, 9 Aug. 1974, *Qinghai-Xizang (Tibet) Complex Expedition 74-4304* (KUN); Zayü Xian, Xia Zayü, 3 Sep. 1976, *C. Y. Wu et al. 5450* (KUN). **Yunnan:** Gongshan Xian, the trail from the Dulong Township to Zayü, 6 Sep. 1982, *Qinghai-Xizang (Tibet) Complex Expedition 9974* (KUN).

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Three New Species of *Salacia* from Mesoamerica (Celastraceae, Salacioideae)

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Abstract. Three new species of *Salacia* L. from Mesoamerica (Celastraceae, Salacioideae) are described from Panama. *Salacia macrocremastra* Lombardi is characterized by its very long pedicels to 50 mm, large flowers to 19 mm diam., and slightly bullate, elliptic leaves with a rounded base. *Salacia mennegana* J. Hedin ex Lombardi is distinguished by its buds with the calyx initially truncate and lobes that grow as the flower expands during anthesis, open inflorescences, annular disk, and ellipsoid fruits. *Salacia panamensis* Lombardi can be recognized by its closed calyx with lobes that are irregular in bud and that tear apart as the flower opens, and its annular-pulvinate, slightly pentagonous disk with outer margin flattened.

Resumo. São descritas para a região Mesoamericana três novas espécies de *Salacia* L. do Panamá (Celastraceae, Salacioideae). *Salacia macrocremastra* Lombardi é caracterizada pelos seus pedicelos muito longos de até 50 mm, flores grandes de até 19 mm diâm., e folhas elípticas, levemente buladas e de base arredondada. *Salacia mennegana* J. Hedin ex Lombardi distinguida pelos botões com cálice inicialmente truncado e lobos que crescem conforme a flor se expande na antêse, inflorescências laxas, disco anular e frutos elipsóides. *Salacia panamensis* Lombardi que pode ser reconhecida pelo cálice fechado no botão, com lobos irregulares que se separam conforme a flor abre, e pelo disco anular-pulviniforme, levemente pentágono e de margem externa achatada.

Key words: Celastraceae, IUCN Red List, Mesoamerica, *Salacia*, Salacioideae.

Celastraceae currently include the former family Hippocrateaceae divided in two subfamilies, the Hippocrateoideae, with 19 genera and ca. 100 species, and the Salacioideae, with six genera and ca. 260 species (Simmons, 2004) distributed worldwide in tropical and subtropical areas.

The limits between genera are controversial in the Hippocrateaceae, and their recognized numbers range from two, *Salacia* L. and *Hippocratea* L. (Peyritsch, 1878), to 25 (Simmons, 2004). This work follows the current concept that splits Neotropical Hippocrateoideae into eight genera, *Anthodon* Ruiz & Pavón, *Cuervea* Triana ex Miers, *Elachyptera* A. C. Smith, *Hippocratea*, *Hylenaea* Miers, *Prionostemma* Miers, *Pristimera* Miers, and *Semialarium* N. Hallé; and Salacioideae in four genera, *Cheiloclinium* Miers, *Peritassa* Miers, *Salacia*, and *Tontelea* Miers (Smith, 1940; Mennega, 1997; Simmons, 2004).

Salacia is a genus with ca. 200 species (Mennega, 1997), with Smith (1940) recognizing 29 species from the Neotropics. Mennega (1984, 1991) later described four other species and Lombardi (2007) another four. The last comprehensive taxonomic study of the genus, although unpublished, is by Hedin (1999), who recognized 38 species in the Neotropics, 20 with fasciculate inflorescences, including two new taxa from Ecuador and Peru.

The probable paraphyly of *Salacia* s. str. was pointed out by recent molecular studies (Simmons et al., 2001a, b). Worldwide analyses of representative species from both the Old and New Worlds are still needed before any generic realignment can be proposed.

While working on the monographic treatment of Hippocrateaceae for the Flora Mesoamericana Project, I encountered all 12 genera, with at least 28 species, and here recognize three new *Salacia* species.

1. Salacia macrocremastra Lombardi, sp. nov. TYPE: Panama. Darién: Parque Nac. Darién, ridge betw. Río Topalisa & Río Pucuro, ca. 17 km E of Pucuro, La Laguna area, 08°03′N, 77°17′W, 750–850 m, 18 Oct. 1987, *B. Hammel, G. de Nevers, H. Cuadros & H. Herrera 16285* (holotype, MO; isotype, PMA). Figure 1.

Haec species *Salaciae grandifoliae* (Martius ex Schultes) G. Don, *S. juruanae* Loesener et *S. macranthae* A. C. Smith foliis magnis (22–43.5 × 5.6–13.4 cm) et inflorescentiis fasciculatis affinis, sed a his duabus floribus majoribus (ca. 19 mm diam. sub anthesi), ab omnibus pedicellis longioribus (40–50 mm longis) et foliis bullatis ad basin rotundatis differt. Etiam ab eis omnibus distributione geographica ad Panamam endemica distincta.

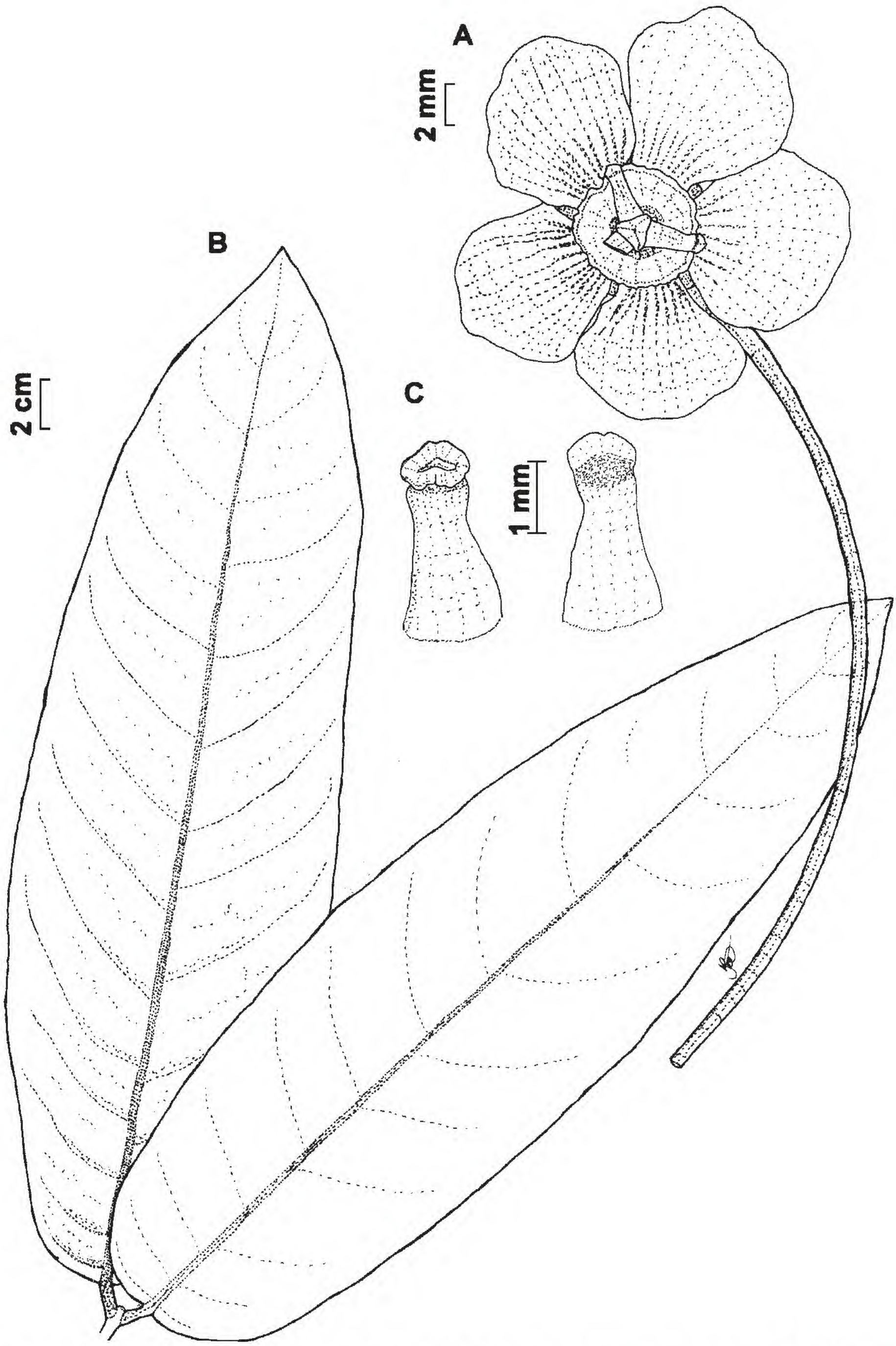

Figure 1. *Salacia macrocremastra* Lombardi. —A. Apical view of flower, with one stamen missing. —B. Branch with leaves. —C. Adaxial and abaxial view of stamen. A–C drawn from the holotype *Hammel et al. 16285* (MO). Drawings by the author.

Lianas, glabrous, branches subterete, new growth ones flattened, smooth to sparsely lenticellate, drying light brown to yellowish, surface rigid, fissured in irregular plates, old ones cylindric, sparsely lenticellate, fissured, drying brown. Leaves opposite to subopposite; stipules 0.4–0.7 mm, triangular, caducous; petioles 10–29 mm, obscurely canaliculate, drying wrinkled and brown; blades 22–43.5 × 5.6–

13.4 cm, elliptic, with rounded or reniform base, apex acute or rarely acuminate or emarginate, margin entire, thickened, slightly revolute, slightly bullate, chartaceous, drying olive-green or light brown on both sides, venation brochidodromous with veins immersed on adaxial side, prominent on abaxial side, secondary veins immersed or plane on abaxial side, plane or slightly prominent on abaxial side, tertiary veins invisible on both sides. Inflorescence fasciculate, with 2 to 4 flowers, ramiflorous on leafless nodes or trunciflorous; bracts inconspicuous, scalelike, fimbriolate; pedicels 40–50 mm, terete. Flower bud unknown; open flowers cream, tannish pink, or dull green with brown center, ca. 19 mm wide at anthesis; sepals 5, 2.6–2.8(–3.7) × 3.1–3.3(–4.2) mm, elliptic, cucullate, margin entire; petals 5, 7.5–7.7 × (7.7–) 8.6–8.8 mm, widely elliptic, unguiculate, spreading at anthesis; petals dull green at tip, grading to brownish purple at base, margin entire; disk ca. 0.5 × 2–2.2 mm, patelliform, carnose, outer margin wrinkled, internal margin raised, drying brown; stamens 3, 2.6–2.8 mm, filaments 1.9–2 mm, flattened, slightly larger at the apex; anthers 0.65–0.75 × 0.85–0.9 mm, oblong, basifixed, bilocular, dehiscence by apical slits bent at ca. 90°, connective apex triangular, conspicuous; pistil pyramid-shaped, ovary ca. 1.8 mm wide, 3-angled, 3-locular, with 6 ovules in each locule, style obsolete, stigmas obscure, punctiform, orange. Berries not seen; seeds not seen.

Distribution and habitat. *Salacia macrocremastra* is apparently restricted to Panama, where it occurs at altitudes of 650–850 m and was reported in disturbed remnants of premontane wet forest and in forest along ridges and streams. This species is reported to occur inside the Parque Nacional del Darién (*Hammel et al. 16285*) and is protected, at least to a certain extent. Nonetheless, it is considered Endangered (EN) according to IUCN Red List criteria because its area of occurrence is less than 5000 km^2, it is known to occur at only three locations, and a continuing decline of its area of occupancy is inferred for habitat fragmentation (IUCN, 2001).

Phenology. The new species has been collected with flowers in January, April, and October; fruits not seen.

Etymology. The specific epithet refers to the very long pedicels, which are unique among *Salacia* species in the New World.

Discussion. *Salacia macrocremastra* strongly resembles *S. grandifolia*, *S. juruana*, *S. gigantea* Loesener, *S. macrantha*, and the here-described *S. panamensis* Lombardi because of its large leaves, and *S. macrantha* because of its large flowers. Nevertheless, *S. grandifolia* is restricted to Brazilian Atlantic rainforests and has smaller flowers (14.5–16.3 mm) with shorter pedicels (3–11 mm); *S. juruana* and *S. gigantea* are restricted to the rainforests of the Amazon Basin and have smaller flowers (9–18 mm) with shorter pedicels (1–19 mm); *S. macrantha* is restricted to the rainforests of the Amazon Basin and has larger, yellow-green flowers (18–24 mm) with shorter pedicels (6–22 mm); and *S. panamensis* has smaller flowers (11–13 mm) with shorter pedicels (9–10 mm) and a peculiar calyx with fused sepals. None of the above species have bullate leaves with a rounded or reniform base, as seen in the new species.

The frequency of browsed stamen apices, which are probably eaten by insects, suggests that the filament apex or the connective itself may be nectariferous.

Among the Neotropical *Salacia* species, this species is notable for having the longest pedicels (to 50 mm), followed by *S. kanukuensis* A. C. Smith (19–27 mm) and *S. odorata* Lombardi (20–24 mm).

Paratypes. PANAMA. **Coclé:** El Cope, W of sawmill, 5 Apr. 1978, *B. Hammel 2387* (MO, PMA). **Panamá:** 6.5 km by rd. N of Lago Cerro Azul, 650–730 m, 13 Jan. 1974, *M. Nee 9289* (MO, PMA).

2. Salacia mennegana J. Hedin ex Lombardi, sp. nov. TYPE: Panama. Darién: S of El Real, Alturas de Nique, near Cana mine, along trail following old Camino Real toward Colombia, 07°45′N, 77°40′W, 24 Aug. 1987, *G. McPherson 11577* (holotype, MO; isotypes, MEXU, PMA). Figure 2.

Haec species quoad inflorescentiam ramosam *Salaciae opacifoliae* (J. F. Macbride) A. C. Smith et *S. insigni* A. C. Smith similis, sed a hac foliis in sicco brunneis et petiolis brevioribus, ab illa inflorescentia laxiore, ab ambabus calyce gamosepalo differt. Etiam ab ambabus distributione in Colombia Panama et Costa Rica (nec in sylva amazonica) differt.

Liana, glabrous, branches terete to subterete, new growth ones conspicuously flattened, sparsely or minutely lenticellate, drying grayish brown, old ones cylindric or subcylindric, fissured, dense or sparsely minutely lenticellate, drying brown. Leaves opposite to subopposite; stipules 0.4–0.5 mm, triangulate, caducous; petioles 2(–3) mm, obscurely canaliculate, drying black; blades (3.8–)8.1–14.8 × (0.9–)2.7–6.2 cm, elliptic, with rounded base, apex long acuminate to acuminate, margin entire, thickened, and cream colored, chartaceous, drying dark brown on the adaxial side, light brown on the abaxial side, venation brochidodromous with veins plane on adaxial side, secondary veins raised on abaxial side, prominulous on abaxial side, tertiary veins plane or

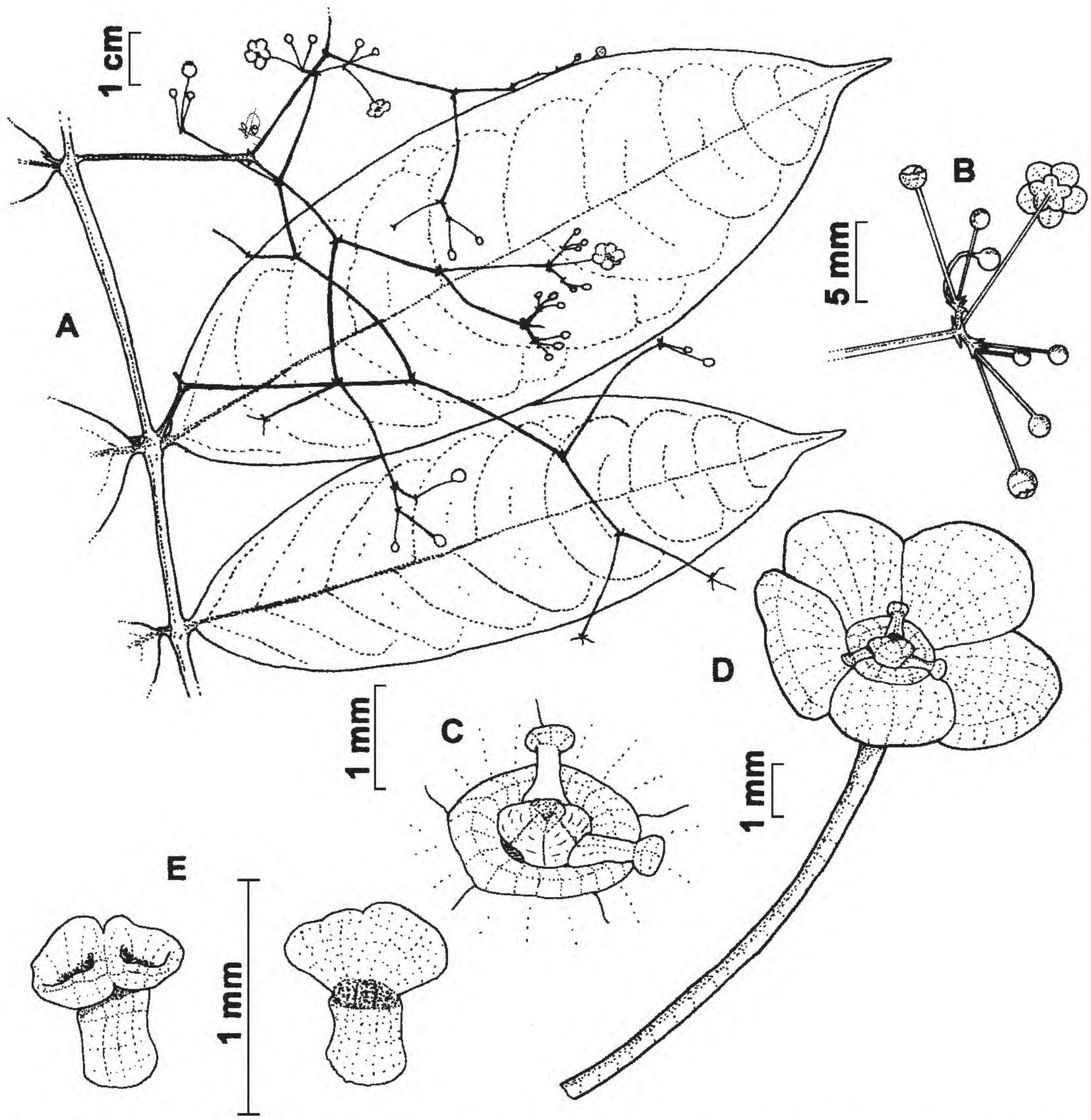

Figure 2. *Salacia mennegana* J. Hedin ex Lombardi. —A. Branch with leaves and inflorescences. —B. Detail of inflorescence and buds, showing the underside of the calyx. —C. Lateral view of disk, stamens, and pistil, with one stamen removed. —D. Apical view of flower. —E. Adaxial and abaxial view of stamen. A–E drawn from the holotype *McPherson 11577* (MO). Drawings by the author.

invisible. Inflorescence (2.6–)4.7–8(–10.9) × 5.2–9 (–19.9) cm, a slender compound dichasia, with 24 to 56 flowers, sometimes on leafless nodes; peduncles 1–2(–15) mm, terminal aggregated inflorescences with peduncles up to 51 mm, flattened, lenticellate, branches opposite; bracts 0.8–1.1 mm, triangular, margin scarious, minutely erose; pedicels (5.5–)8–10.3 mm, terete. Flower bud spherical; open flowers orange to pale brown, 4–6.5 mm wide at anthesis; calyx in bud tubular, truncate, ca. 1.3 × 2.3 mm, lobes 5, growing at anthesis, 0.8–1.1 × 1.1–1.3 mm, elliptic, margin minutely papillose; petals 5, 2.3–3.1 × (2.2–)2.7–3.8 mm, widely elliptic to transverse elliptic, unguiculate, ± carnose, spreading at anthesis, brown to orange, drying brown, margin minutely denticulate; disk 0.2–0.3 × 0.4–0.6 mm, annular, slightly pentagonous, carnose, outer margin rounded, orange-brown to dark orange; stamens 3, 0.8–1.1 mm, filaments 0.5–0.9 mm, flattened, anthers 0.25–0.5 × 0.6–0.7 mm, reniform, basifixed, bilocular, dehiscence by apical slits bent at ca. 120°, pistil pyramid-shaped, ovary ca. 0.8 mm wide, 3-angled, 3-locular, with (4)5 ovules in each locule, style obsolete, stigmas obscure, punctiform. Mature berries

(3.2–)5.5–6.9 × 2.5–3 cm, ellipsoid, exocarp crustaceous, ca. 1.4 mm thick, yellow-orange, drying slightly tuberculate and dark brown; seeds 1.5–2 × ca. 0.8 cm, ellipsoid, enclosed in colorless and translucent pulp.

Distribution and habitat. *Salacia mennegana* is apparently restricted to Colombia, Panama, and Costa Rica, where it occurs at altitudes of (100–)850–1100 m and has been reported in tall, selectively logged forest and forested slopes. This species is not reported inside any official conservation unit and is thus unprotected. It is considered Vulnerable (VU) according to IUCN Red List criteria because its area of occurrence is less than 5000 km^2, it is known to occur at fewer than 10 locations, and a continuing decline of its area of occupancy is inferred for habitat fragmentation (IUCN, 2001).

Phenology. The new species has been collected with buds and flowers in February, August, and November, and with mature fruits in April.

Etymology. The specific epithet honors Alberta Maria Wilhelmina Mennega, wood anatomist and distinguished taxonomist of New World Hippocrateaceae.

Discussion. *Salacia mennegana* resembles *S. opacifolia* and *Peritassa pruinosa* (Seemann) A. C. Smith because of its leaf shape, short petioles, and the color of the dried leaf blade; it is difficult to distinguish with only vegetative material. Nevertheless, *S. mennegana* can be recognized by its looser inflorescences (vs. inflorescences 0.8–3.1 × 0.5–4.3 cm in *P. pruinosa* and 0.9–3.4[–5.1] × 0.5–1.5[–6.9] cm in *S. opacifolia*) and fused sepals (vs. typical Salacioideae with free sepals in the other two species).

Salacia mennegana differs from *S. insignis*, which also has loose branched inflorescences, by its leaves that dry brown (vs. green), its shorter petioles (vs. 4–18 mm), and its fused sepals.

Jennifer Hedin recognized this species in her dissertation and intended to name it in honor of Dr. Mennega (as "*mennegae*"; Hedin, 1999: 176), but this name has remained unpublished to date. Hedin (1999) noted that this species is closely related to *Salacia insignis* and *S. opacifolia* because of their similar branched inflorescences and floral morphology.

Paratypes. COLOMBIA. **Chocó:** Jequedó, 41 km W of Las Animas on Pan-American Hwy., ca. 10 km E of Río Pato, 220 m, 12 Jan. 1979, *A. Gentry & E. Renteria A. 24101* (MO [2]). COSTA RICA. **Puntarenas:** Osa Peninsula, Aguabuena, 3 km W of Rincón, 08°42′N, 83°30′W, 130 m, 17 Apr. 1993, *K. Thomsen 349* (C, U); 10 Aug. 1994, *Thomsen 987* (NY). PANAMA. **Panamá:** 8 km N of Cerro Azul on rd. to Cerro Jefe, 732 m, 13 Nov. 1965, *K. E. Blum, R. K. Godfrey & E. Tyson 1689* (MO); near continental divide, valley of Río Mamoni, 16 km by rd. N of Chepo, ca. 09°20′N, 79°08′W, ca. 400 m, 21 Feb. 1986, *G. McPherson 8470* (MEXU, MO); along El Llano–Carti rd., ca. 7.4 km from Pan-American Hwy., ca. 09°15′N, 79°00′W, ca. 350 m, 22 Aug. 1986, *G. McPherson 9958* (MO, PMA).

3. Salacia panamensis Lombardi, sp. nov. TYPE: Panama. Panamá: Cerro Jefe, along rd. to summit, 09°15′N, 79°30′W, 12 Dec. 1986, *G. McPherson 10018* (holotype, MO; isotype, PMA). Figure 3.

Haec species quoad folia magna et inflorescentiam fasciculatam *Salaciae grandifoliae* (Martius ex Schultes) G. Don et *S. juruanae* Loesener similis, sed a hac habitu non scandenti, ab ambabus calyce in alabastro clauso sub anthesi in lobos 5 irregulares diviso et floris aperti colore pallide-viridi centro brunneo differt. Etiam distributione geographica distincta ad Panamam endemica differt.

Trees 4–10 m high or treelets 2–4 m high, glabrous, branches subterete, new growth ones cylindric, compressed in the nodes, not lenticellate or sparsely lenticellate, shiny, drying ochre or brown, minutely wrinkled, old ones cylindric, fissured, lenticellate, shiny, drying brown-red. Leaves opposite to subopposite; stipules not seen, caducous; petioles 10–27 mm, obscurely canaliculate, drying wrinkled and black; blades 17.2–30.7(–39.5) × (7.9–)10–18 (–19.3) cm, elliptic, base rounded or cuneate, apex acute, rarely obtuse, margin entire, thickened, slightly revolute, chartaceous, yellow-green on abaxial side, drying brown or olive-brown on both sides, venation brochidodromous with veins prominent on both sides, secondary veins plane or immersed on abaxial side, invisible on adaxial side, tertiary veins invisible on both sides. Inflorescence a contracted brachyblast and apparently fasciculate, with 2 to 4 flowers, ramiflorous on leafless nodes or trunciflorous; bracts inconspicuous, scalelike, fimbriolate; pedicels 9–10 mm, terete. Flower bud spherical; open flowers pale green with brown center, 11–13 mm wide at anthesis; calyx closed in very young buds that grow tearing into 5 irregular lobes, lobes (1.8–)2.3–3.1 × (2–)2.3–2.4 (–3.4) mm, triangular, margin minutely irregular, dried and black; petals 5, 4.4–4.8(–6.3) × 3.4–4.4 (–5.4) mm, obovate, carnose, spreading at anthesis, pale green with brown at its base, base probably nectariferous, margin entire; disk 1.3–1.8 × ca. 0.9 mm, annular-pulvinate, slightly pentagonous, carnose, orange, brown, or pale red, outer margin flattened, drying dark brown; stamens 3, 1.4–1.8 mm, filaments 1.1–1.4 mm, flattened, anthers 0.3–0.45 × 0.5–0.6 mm, reniform, orange, basifixed, bilocular, dehiscence by apical slits bent at ca. 120°; pistil pyramid-shaped, ovary ca. 1.5 mm wide, 3-angled, white or pink-white, 3-locular, with 5 ovules in each

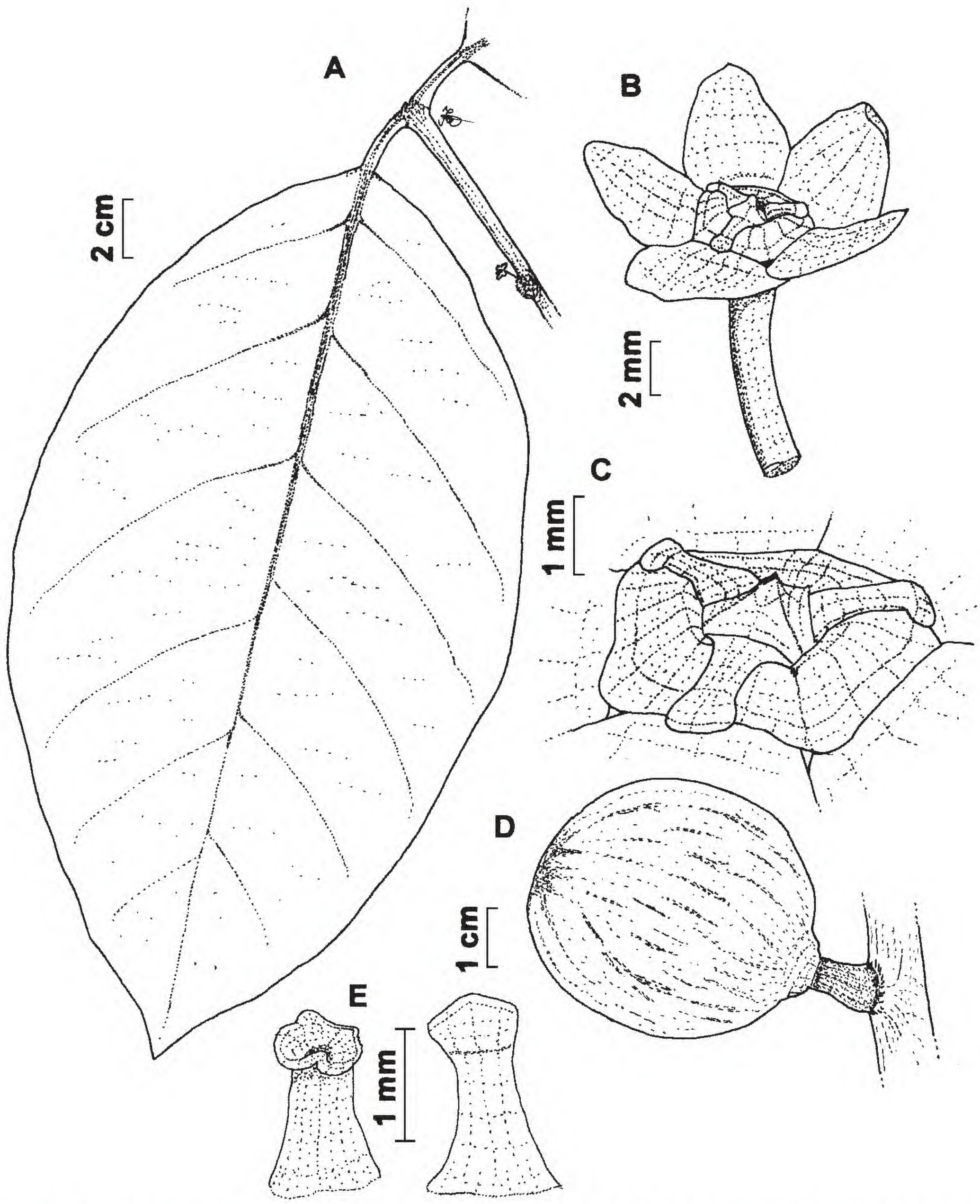

Figure 3. *Salacia panamensis* Lombardi. —A. Branch with leaves. —B. Apical view of flower. —C. Lateral view of disk, stamens, and pistil. —D. Mature fruit. —E. Adaxial and abaxial view of stamen. A drawn from *Galdames 4149* (MO); B, C, E drawn from the holotype *McPherson 10018* (MO); D drawn from *Mori & Kallunki 5482* (MO). Drawings by the author.

locule, style obsolete, stigmas obscure, punctiform. Entire mature berries not seen, immature berries 3.6–4.8 × 2.2–4.4 cm, spherical, exocarp coriaceous, immature green with grayish striations, mature yellow, drying brown; seeds ca. 1.1 × 0.9 cm, ellipsoid, orange, enclosed in white and translucent pulp.

Distribution and habitat. *Salacia panamensis* is apparently restricted to Panama, where it occurs at altitudes of 200–300 to 800–1000 m and was reported in cloud forests, premontane wet forests, secondary forest, and riverbank lowland rainforests, in transition to premontane forests. This species is reported to

occur inside the Parque Nacional Altos de Campana (*Galdames 4149* and *4380*) and has a protected status, nonetheless it is considered Vulnerable (VU) according to IUCN Red List criteria because its area of occurrence is less than 5000 km², it is known to occur at no more than 10 locations, and a continuing decline of its area of occupancy is inferred for habitat fragmentation (IUCN, 2001).

Phenology. The new species has been collected with buds and flowers from December to February, and in April, August, and September; it has been collected with mature fruits in April, August, and November and with immature ones in December.

Etymology. The specific epithet refers to the country where this species is apparently endemic.

Discussion. The inflorescence of *Salacia panamensis* is not a true fascicle, but a very contracted brachyblast with successive flowerings, the oldest being bigger and higher than the newest, which was presumably produced in the year of specimen collection. Hedin (1999: 72) describes this inflorescence type as a "highly contracted cyme."

Salacia panamensis strongly resembles *S. grandifolia* because of its large leaves (blades [10.4–]25.8–29[–32] × [5.1–]5.5–7.9[–15] cm in *S. grandifolia*) and habit and *S. juruana* because of its large leaves (blades [10.1–]17.6–25.6[–46.5] × [3.8–]4.8–7.5 [–14.7] cm in *S. juruana*). However, *S. grandifolia* is restricted to Brazilian Atlantic rainforests, and *S. juruana* is restricted to rainforests of the Amazon Basin. In addition, both species have sepals that are not initially connate, but developmentally free with fimbriolate margins.

The base of the petals is probably nectariferous, and copious nectar was reported on the flowers (*Knapp 1354*). In studied specimens, the petal bases were often scraped by insects.

Hedin (1999: 59) recognized the peculiar calyx of both *Salacia mennegana* and *S. panamensis* in her dissertation and associated it with the calyptra-like calyx of the Malaysian species of *Salacicratea* Loesener. She described the calyx of *Salacia mennegana* as "...a smooth sheath over the bud, but as the flower expands, this sheath tears into five or sometimes more unequal to subequal parts" and the calyx of *S. panamensis* (not named by her) as a "...three-parted calyx in which the segments are valvate... ." In my interpretation, the calyx segments of *S. mennegana* do not tear apart but grow into separate lobes, which is strongly suggested by the papillose margins. In addition, the lobes of *S. panamensis* do not start as free valvate parts, but as a closed bud in which the growing flower center bursts the segments apart. This is supported by the irregular and dried black margins of the calyx lobes.

Paratypes. PANAMA. **Colón:** Santa Rita ridge, SE of Colón, ca. 19 rd. km from Trans-Isthmiam Hwy., 09°25′N, 79°40′W, ca. 500 m, 17 Sep. 1987, *G. McPherson 11761* (MO). **Darién:** Cerro Pirre, 760–1370 m, 9–10 Aug. 1967, *J. A. Duke & T. S. Elias 13713* (MO); N slopes of Cerro Pirre, ca. 700–950 m, 7 Apr. 1975, *S. Mori & J. Kallunki 5482* (MO). **Panamá:** Miraflores Annex TTC, beside the laboratory, 31 Aug. 1967, *M. D. Correa 217* (MEXU, MO, NY, PMA); después del Lago Goofy en el camino a Cerro Jefe, 14 Jan. 1968, *M. D. Correa & R. L. Dressler 574* (MO, PMA); Parque Nac. Altos de Campana, recorrido desde Margano, Las Nubes a Trinidad Arriba, Sendero Las Nubes, 11 Apr. 1997, *A. Espinosa 729* (PMA); ca. 5 km de la carr. Llano–Cartí, 1 July 1994, *C. Galdames 1203* (PMA, SCZ); Parque Nac. Altos de Campana, Serranía del Llorón, NW del poblado de Bejuco, 08°41′N, 79°57′W, 600–700 m, 20 Feb. 1998, *C. Galdames 4149* (MO, PMA, SCZ); 08°41′N, 79°56′W, ca. 700 m, 3 Feb. 1999, *C. Galdames 4380* (MO, PMA, SCZ); Cerro Jefe, 800–1000 m, 21 Dec. 1972, *A. Gentry 6789* (MO); ca. 10 km N of Pan-American Hwy. on El Llano–Cartí rd., ca. 500 m, 12 Dec. 1973, *A. Gentry, M. Nee & R. L. Dressler 8885* (MO); El Llano–Cartí rd. ca. 17 km from Pan-American Hwy., 09°15′N, 78°50′W, ca. 400 m, 30 Sep. 1981, *S. Knapp 1354* (MO); along El Llano–Cartí rd., 9.5 km N of Pan-American Hwy., along trail W of rd., 09°15′N, 79°00′W, 200–300 m, 9 Apr. 1987, *G. McPherson 10810* (MO); 4.5 km N of Lago Cerro Azul by rd., vic. of Finca Vega, 675 m, 17 Sep. 1973, *M. Nee 7033* (MO, PMA, US); El Llano–Cartí rd., 13 km from Pan-American Hwy., 300–400 m, 17 Apr. 1981, *K. J. Sytsma 4021* (MO, PMA). **San Blas [Kuna Yala]:** Nusagandi, sede de campo de PEMASKY, 29 Mar. 1992, *R. Paredes 617* (SCZ).

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Two New Species of Orchidaceae from Brazil: *Bulbophyllum carassense* and *Lepanthopsis vellozicola*

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Abstract. Two new species of Orchidaceae from the Serra do Caraça, state of Minas Gerais, Brazil, are described and illustrated. *Bulbophyllum carassense* R. C. Mota, F. Barros & Stehmann is endemic to the Serra do Caraça and is epiphytic on trees or sometimes rupicolous. It is related to *B. bidentatum* (Barbosa Rodrigues) Cogniaux, *B. filifolium* Borba & Smidt, and *B. plumosum* (Barbosa Rodrigues) Cogniaux, all belonging to section *Xiphizusa* (Reichenbach f.) Cogniaux. A table comparing diagnostic characters for *B. carassense* with morphologically related species is presented. The second new species is *Lepanthopsis vellozicola* R. C. Mota, F. Barros & Stehmann, which is also rare and endemic to this region as an epiphyte on *Vellozia compacta* Martius, in campos rupestres vegetation. This is the only species in *Lepanthopsis* (Cogniaux) Ames with the following combination of characters: the secondary stems show only two evident internodes and are subtended by two leaf sheaths with smooth margins, and the lateral sepals are completely connate. A taxonomic key to identify the Brazilian species of *Lepanthopsis* is presented.

Resumo. Duas novas espécies de Orchidaceae, ambas procedentes da Serra do Caraça, Minas Gerais, Brasil, são descritas e ilustradas. *Bulbophyllum carassense* R. C. Mota, F. Barros & Stehmann é rara e endêmica da Serra do Caraça e do seu entorno, epífita e ocasionalmente rupícola. Tem afinidade com *B. bidentatum* (Barbosa Rodrigues) Cogniaux, *B. filifolium* Borba & Smidt e *B. plumosum* (Barbosa Rodrigues) Cogniaux, todas da seção *Xiphizusa* (Reichenbach f.) Cogniaux. É apresentada uma tabela comparativa dos caracteres morfológicos de *B. carassense* e suas espécies relacionadas. A segunda espécie é *Lepanthopsis vellozicola* R. C. Mota, F. Barros & Stehmann, também rara e endêmica da Serra do Caraça, crescendo exclusivamente como epífita sobre *Vellozia compacta* Martius, na vegetação de campo rupestre. É a única espécie do gênero a apresentar as seguintes características: caule secundário com dois entrenós evidentes, associados a duas bainhas foliares com margens lisas, e sépalas laterais totalmente conadas. É apresentada uma chave taxonômica artificial para identificação das espécies de *Lepanthopsis* (Cogniaux) Ames ocorrentes no Brasil.

Key words: Brazil, *Bulbophyllum*, IUCN Red List, *Lepanthopsis*, Minas Gerais, Orchidaceae, Serra do Caraça.

In Brazil, the Serra do Caraça is located in the municipalities of Catas Altas, Mariana, and Santa Bárbara in Minas Gerais and is part of the Quadrilátero Ferrífero (the Iron Quadrangle), the southernmost portion of the Serra do Espinhaço. The climate is characterized by mild and rainy summers and dry winters, with a mean annual precipitation of 1500 mm (Brandão et al., 1994). Mild temperatures prevail throughout the year, with maximum temperatures seldom exceeding 30°C and minimum temperatures sometimes reaching below zero, mainly at high altitudes. The Serra do Caraça includes rocks of the

Minas Supergroup and Cenozoic period (Dutra et al., 2002), and the altitude ranges from 750–2072 m. The elongated amphitheater shape of the range is formed by many peaks, and the north-facing opening harbors the Caraça Sanctuary, at about 1300 m (Silveira, 1924). This is the headquarters of the Reserva Particular do Patrimônio Natural do Caraça, the largest private preservation area in the range. Rainwater flows into the Piracicaba river basin, which is part of the Doce river basin.

The Serra do Caraça is located in the Atlantic Forest biome, comprising mainly grasslands that are surrounded and interspersed with forests. The dominant phytophysiognomy are campos rupestres (rocky fields or rocky grasslands) and semideciduous forests. Campos rupestres vegetation is characterized by a variety of herbaceous plants or shrubs growing directly on rocks, in rock crevices, or on the flat sandy dark soil accumulated on top. The semideciduous forests are often located on slopes and/or associated with the rocky fields.

Two new species of the genera *Bulbophyllum* Thouars and *Lepanthopsis* (Cogniaux) Ames were found during the inventory of the family Orchidaceae in the Serra do Caraça. Both are described and illustrated here: *B. carassense* R. C. Mota, F. Barros & Stehmann belongs to section *Xiphizusa* (Reichenbach f.) Cogniaux, and *L. vellozicola* R. C. Mota, F. Barros & Stehmann belongs to section *Lepanthopsis*.

The genus *Bulbophyllum* is pantropical and is composed of almost 1000 species (Dressler, 1993). Almost 60 species are known in Brazil (Smidt & Borba, 2007), in five sections (Pabst & Dungs, 1975): *Bulbophyllaria* (Reichenbach) Grisebach, *Didactyle* (Lindley) Cogniaux, *Micrantha* Barbosa Rodrigues, *Napellii* Reichenbach, and *Xiphizusa*. *Bulbophyllum carassense* is assigned to section *Xiphizusa*, which currently includes 13 Brazilian species, most of which are epiphytic in southeastern Brazil forests, with a few that are rupicolous in rocky fields (Borba & Smidt, 2004). This section is distinguished by its slender and nongeniculate inflorescences, long lateral sepals fused to each other up to the apex forming a synsepal, columns with two long stelidia close to the apex and two small ventral teeth, and an aggregate and corrugated secondary stem.

The genus *Lepanthopsis* currently comprises 43 species and is widespread in tropical rainforests from Mexico through Central America and the West Indies, to southern Brazil, mainly in areas higher than 1000 m, with the highest species concentration in the West Indies (Luer, 1991). *Lepanthopsis densiflora* (Barbosa Rodrigues) Ames and *L. floripecten* (Reichenbach f.) Ames, the two species of the genus known from Brazil, are found in southern and southeastern Brazil.

1. **Bulbophyllum carassense** R. C. Mota, F. Barros & Stehmann, sp. nov. TYPE: Brazil. Minas Gerais: Catas Altas, Serra do Caraça, 20°04′55.2″S, 43°29′11.7″W, 1200 m, 20 Mar. 2005 (fl.), *R. C. Mota 2819* (holotype, BHCB; isotypes, RB, SP). Figure 1.

Affine *Bulbophyllo bidentato* (Barbosa Rodrigues) Cogniaux, *B. filifolio* Borba & Smidt et *B. plumoso* (Barbosa Rodrigues) Cogniaux sectionis *Xiphizuzae* (Reichenbach f.) Cogniaux, sed habitu plerumque epiphytico, pseudobulbis fortiter corrugatis dorsaliter compressis, foliis lineari-oblongis usque lineari-ellipticis atque labello in dimidio distali vinaceo reliquo eburneo vel flavido et vinaceo-punctato, fascia longitudinali atropurpurascente e basi usque ad apicem ornato differt.

Epiphytic or rupicolous herbs; roots cylindrical, branched or not, white to light green, to 10 × 0.1 cm; rhizome 3–7 mm between successive pseudobulbs; secondary stems modified into pseudobulbs, conspicuously corrugate, glossy, ovoid, slightly to conspicuously dorsally compressed, 1-leaved, dark green to brownish green, aggregate, 4–8.5 × 6–13 mm. Leaves chartaceous to subchartaceous, flat to slightly conduplicate, narrowly oblong to linear-elliptic, dark green, slightly bicolored, 15–65 × 2.5–6 mm, apex acute to mucronate. Inflorescence a raceme, slightly nutant, basal, 1 per pseudobulb; peduncle 24–60 mm; rachis 15–55 mm; peduncular bracts with coalescent margins to the apex, scarious at anthesis, 4–6 mm, the free part lingulate, apex obtuse; floral bracts triangular, scarious at anthesis, 1.5–4 mm, apex acute. Flowers resupinate, 4 to 14 simultaneously opening per inflorescence, facing downward; pedicel and ovary glabrous, brownish green with some vinaceous spots, 1–2 × 1–1.5 mm; dorsal sepal glabrous, membranous, lanceolate to narrowly ovate, erect to patent, cream colored to light green, covered with vinaceous spots, concentrated basally, 6.5–8.5 × 1.8–2.5 mm, concave at base, apex slightly canaliculate, straight to recurved, margin entire to shortly and sparsely ciliate, apex mucronate to acute, lateral sepals glabrous, subcoriaceous, fused to apex, erect to patent, cream colored to light green, vinaceous spotted, especially basally, synsepal 7–8.5 × 2.5–3.5 mm, canaliculate, lanceolate, symmetrical, margin entire, apex acute to acuminate; petals membranous, flat to almost flat, lanceolate to erect to patent, almost entirely vinaceous, 2.5–3.5 × 1–1.4 mm, base asymmetrical, margin long-ciliate, cilia vinaceous to yellowish, apex acute to obtuse; lip glabrous, fleshy, obovate-lanceolate, erect, flat to slightly undulate, sulcate in basal 1/3, flat to slightly canaliculate in apical 2/3, 5.5–7.5

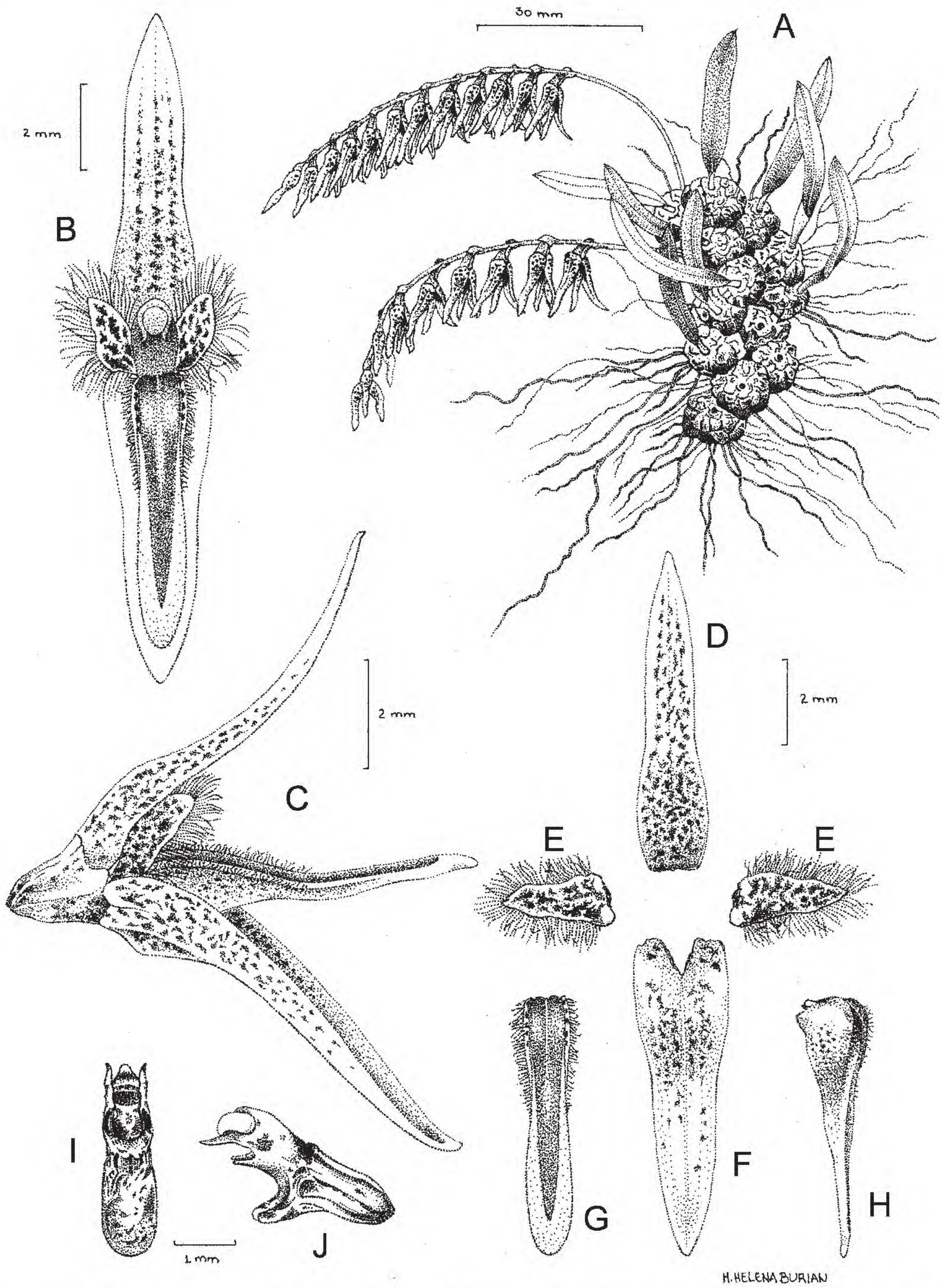

Figure 1. *Bulbophyllum carassense* R. C. Mota, F. Barros & Stehmann. —A. Habit. —B. Flower, frontal view. —C. Flower, side view. —D. Dorsal sepal. —E. Petals. —F. Synsepal formed by the lateral sepals. —G. Lip, frontal view. —H. Lip, lateral view. —I. Column, ventral view. —J. Column, lateral view showing the beak-shaped apical anther. Drawing from living material.

× 0.8–1.2 mm, with a central, longitudinal, salient stripe, which gradually thins apically, the lateral lobes reduced, semilunate, restricted to the basal 1/4 of the lip, projected upward, margin ciliate in basal 1/3 and entire above, apex obtuse, distal half of lip vinaceous with a longitudinal, central, darker vinaceous stripe to the apex, the remaining cream colored to light yellow with some vinaceous spots; column glabrous, slightly curved, erect to patent, cream colored with some vinaceous spotting, 1.3–1.8 × 0.7–0.9 mm, apex apiculate, stelidia laminate, projected upward, with or without 2 small ventral teeth near the median region, teeth, when present, projected upward forming an acute angle with the column axis, column foot fleshy, ovate, frontally compressed, 1–2 mm long; anther cap verrucose, cordate, vinaceous, 0.7–0.8 × 0.5–0.7 mm, apex mucronate, incurved; pollinia 2, subspherical to reniform, hard, yellow, 0.3–0.4 mm; rostellum membranous, laminar, apex truncate; stigma hollow. Fruit spherical, ribbed, glabrous to sparsely tomentose, 4–5 × 3.5–4 mm.

Distribution and habitat. *Bulbophyllum carassense* has only been found in and near the Serra do Caraça. The species occurs as an epiphyte on riverbanks and in semideciduous forests, and sometimes as a rupicolous plant in semideciduous forests between 900 and 1200 m (pers. obs.). It is a rare species and only a few populations have been found so far. Individuals are grouped in isolated tufts of varied sizes, growing upright or hanging on trunks and rocks.

IUCN Red List category. According to the current knowledge of the species and using IUCN Red List categories and criteria (IUCN, 2001), *Bulbophyllum carassense* can be classified as Endangered (EN A2; B1ab[iii]; C1). A few known populations are protected in the Reserva Particular do Patrimônio Natural do Caraça. The endangered populations occur over canga vegetation in the Iron Quadrangle, the most important mining region of southeastern Brazil (Jacobi et al., 2007).

Phenology. *Bulbophyllum carassense* was observed in flower from February to April.

Etymology. The species epithet refers to the type locality, in the Serra do Caraça in Minas Gerais, Brazil.

Diagnostic features. The flowers of *Bulbophyllum carassense* resemble those of *B. bidentatum*, *B. filifolium*, and *B. plumosum*, which all belong to section *Xiphizusa*. Table 1 presents the diagnostic characters for these species.

2. Lepanthopsis vellozicola R. C. Mota, F. Barros & Stehmann, sp. nov. TYPE: Brazil. Minas Gerais: Catas Altas, Serra do Caraça, 20°06′S, 43°27′W, 1850 m, 29 Apr. 2004 (fl.), *R. C. Mota 2437* (holotype, BHCB; isotypes, RB, SP). Figure 2.

Species haec habitu ad *Velloziam* epiphytico, caulibus secundariis internodiis duobus tantum instructis, vaginis foliaribus marginibus laevibus et floribus sepalis lateralibus usque ad apicem coalescentibus ab omnibus congeneris recedit.

Herb epiphytic, caespitose, 5–30 mm tall; roots unbranched, cylindrical to slightly compressed, white to light green, to 40 mm, 1.3 mm diam.; rhizome 0.4–1.5 mm between successive secondary stems; secondary stem glabrous, with basal internodes reduced and covered with imbricate prophylls and 2 evident internodes, cylindrical, not thickened, light green to reddish brown, 0.8–4 × 0.3–0.5 mm; sheaths of the secondary stem 2, glabrous, ribbed, membranous, tubular to crateriform, brownish green, imbricate, unequal, the larger 1.2–4.5 mm, the smaller 0.8–2.5 mm, margins smooth, slightly thickened, apex shortly cuspidate. Leaves glabrous, fleshy, convex on both faces or only the abaxial face, usually sulcate at the median vein, widely elliptic, ovate, or orbicular, light green to reddish brown, slightly bicolorous, 1 per secondary stem, 2.7–9 × 2.5–6 mm, margin entire, apex obtuse, mucronate, base attenuate. Inflorescence a raceme, apical, slightly bending, 1 per secondary stem, longer than the secondary stem and leaf; peduncle glabrous, filiform, brownish green to vinaceous, 4–12 mm; rachis brownish green to vinaceous, 5–25 mm; peduncular bracts glabrous, membranous, infundibular to truncate, 0.8–2.5 mm, the basal bract twice as long as the others, margin entire, apex shortly cuspidate to acute; floral bracts glabrous, membranous, crateriform, 0.7–1.3 mm, margins fused to midpoint, free portion triangular to rounded, margin entire, apex acute to obtuse. Flowers resupinate, 4 to 8 per inflorescence, simultaneously opening, in 2 opposite ranks, with a pectinate appearance along the rachis; pedicel glabrous, slightly ribbed, brownish yellow to vinaceous, 0.6–1 × 0.2–0.3 mm; ovary glabrous, slightly ribbed, brownish yellow to vinaceous, 0.3–0.4 × 0.2–0.3 mm; dorsal sepal glabrous, membranous, concave, ovate to lanceolate, straight to slightly recurved, greenish yellow to vinaceous, sometimes with a darker longitudinal, central stripe, 1.2–2 × 0.6–0.9 mm, margin entire, apex acute, slightly to conspicuously recurved; lateral sepals glabrous, membranous, navicular, fused to each other forming a concave, ovate, erect to patent synsepal, greenish yellow to vinaceous, 1.2–1.7 × 0.8–1.3 mm, margin entire, apex shortly acuminate; petals glabrous, membranous, concave,

Table 1. Comparative morphological traits of *Bulbophyllum carassense* and related species.

	B. carassense	*B. bidentatum*	*B. filifolium*	*B. plumosum*
Habit and habitat	epiphyte or rupicolous in semideciduous and gallery forests	rupicolous, in rocky fields in Minas Gerais	rupicolous, in rocky fields in Minas Gerais	rupicolous in rocky fields or epiphyte in semideciduous and gallery forests; widely distributed in Brazil
Pseudobulbs	ovoid, markedly corrugated and slightly to conspicuously compressed dorsally	conical to subspherical, not compressed dorsally	smooth to only slightly corrugated, not compressed dorsally	conical to subspherical, angled, smooth to slightly corrugated, sometimes slightly compressed dorsally
Leaves	chartaceous to subcoriaceous, flat to slightly conduplicate, narrowly oblong to linear-elliptic, 15–65 × 2.5–6 mm	coriaceous, navicular to conduplicate at the base and slightly conduplicate upward, elliptic to oblong-elliptic, 10–40 × 7–10 mm	coriaceous, flat to slightly conduplicate, linear, 25–40 × ca. 1 mm	coriaceous, flat, oblong-elliptic to oblong, 25–50 × 8–15 mm
No. of flowers per inflorescence	4 to 14	4 to 6	1	5 to 12
Sepals	cream colored to light green, covered by vinaceous spots; dorsal sepal 6.5–8.5 × 1.8–2.5 mm, lateral sepals 7–8.5 × 2.5–3.5 mm	vinaceous; dorsal sepal 4.5–7 × 1.7–2 mm, lateral sepals 4.5–7 × 2–2.5 mm	purple with chestnut-colored spots; dorsal sepal ca. 14 × 3 mm, lateral sepals 13–15 × 4–6 mm	chestnut colored; dorsal sepal 15–20 × 3–4 mm, lateral sepals 15–20 × 4–5 mm
Dorsal petals	margin ciliate, vinaceous, 2.5–3.5 × 1–1.4 mm	margin pilose, vinaceous with purple central vein, 1.7–2.2 × ca. 1.5 mm	margin pilose, vinaceous with purple central vein, ca. 4 × 3 mm	margin pilose, white with purple central vein, 5–7 × 2–2.5 mm
Lip	fleshy, obovate-lanceolate, 5.5–7.5 × 0.8–1.2 mm	margin entire, purple, fleshy, lineate, 4.5–6 × 1.3–1.5 mm	margin pilose in basal portion, short hairs, purple, fleshy, oval, ca. 9 × 1.7 mm	margin pilose in basal portion, short hairs, chestnut colored with purple stripes, membranous in apical 2/3, spatulate, 14–18 × 1.5–2 mm

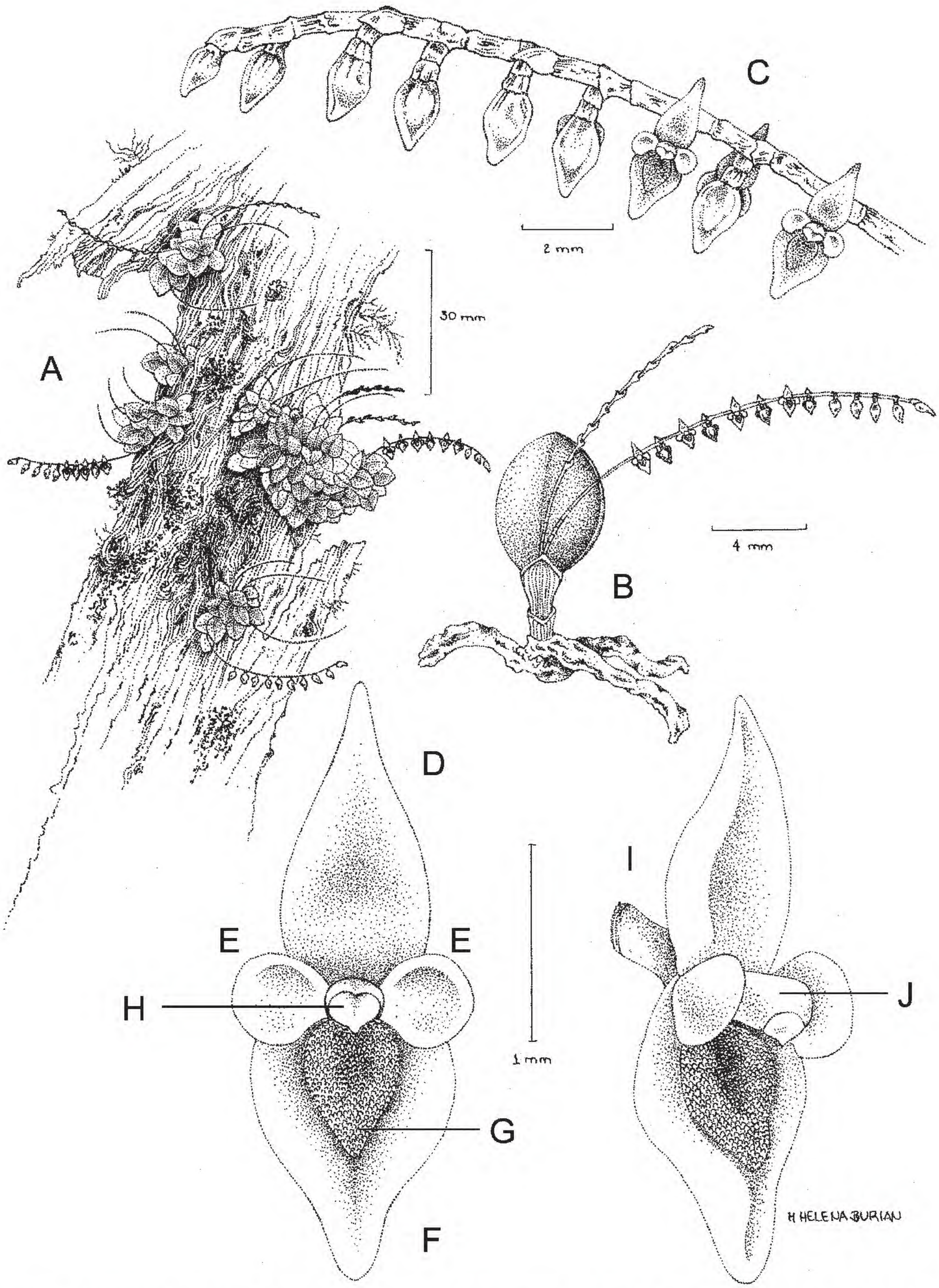

Figure 2. *Lepanthopsis vellozicola* R. C. Mota, F. Barros & Stehmann. —A. Habit of plants over a *Vellozia* branch. —B. An isolated flowering sympodium with roots. —C. Detail of an inflorescence. —D. Dorsal sepal. —E. Petals. —F. Synsepal formed by the lateral sepals. —G. Lip. —H. Anther. —I. Flower, oblique view. —J. Column. Drawing from living material.

broadly obovate to subspherical, slightly asymmetric, erect to patent, greenish yellow to brownish yellow, 0.5–0.7 × 0.4–0.7 mm, margin entire, apex obtuse to rounded; lip glabrous at the abaxial face, papillose at the adaxial face, fleshy, concave, ovate, erect to patent, 0.6–0.9 × 0.5–0.7 mm, yellow, greenish yellow, or brownish yellow, margin papillose, apex acute to obtuse, column glabrous, erect to patent,

curved at the dorsal region, straight at the ventral region, apical portion larger than the basal portion, yellow to yellowish green, sometimes with some vinaceous spots, 0.4–0.6 × 0.3–0.5 mm, apex obtuse, column foot 0.1–0.2 mm; anther slightly papillose, white to cream colored, ca. 0.2 × 0.3 mm; pollinia 2, subspherical to obovoid, hard, yellow, 0.1–0.15 × 0.05–0.08 mm; rostellum oblong to triangular, apex rounded, stigmatic cavity flat. Fruit spherical to widely ellipsoid, ribbed, 1.9–2.1 × 1.5–1.7 mm.

Distribution and habitat. *Lepanthopsis vellozicola* is currently known to occur only in the Serra do Caraça, state of Minas Gerais, Brazil. The species grows exclusively as an epiphyte on *Vellozia compacta* Martius in rocky fields between 1750 and 1900 m (pers. obs.). It is a very rare species and only a few populations have been encountered so far. Individuals of this species form tufts of varied sizes that are usually isolated from one another, but many individuals can often be found on a single host plant.

IUCN Red List category. According to the current knowledge of the species and using IUCN Red List categories and criteria (IUCN, 2001), *Lepanthopsis vellozicola* can be classified as Critically Endangered (CR B2ab[iii]). The only known population grows along the trail leading to Pico do Sol, a popular spot for hikers and climbers in the Serra do Caraça.

Phenology. *Lepanthopsis vellozicola* was observed in flower from February to May.

Etymology. The specific epithet refers to the observation that the species is epiphytic on *Vellozia* Vandelli.

Diagnostic features. The new species is unique in the genus by the smooth margins of the two leaf sheaths of its secondary stem, the presence of only two evident internodes on each secondary stem, the lateral sepals that are fused to the apex, and by appearing as an epiphyte exclusively on *Vellozia*. Its vegetative habit somewhat resembles that of *Lepanthopsis microlepanthes* (Grisebach) Ames, since both are minute plants. Both possess the smallest leaves and secondary stems within the genus and both have leaves longer than or equaling the respective secondary stem. In all other characteristics, however, the two species are distinct and belong to different subgenera, with *L. microlepanthes* belonging to subgenus *Microlepanthes* Luer. *Lepanthopsis vellozicola* belongs to section *Lepanthopsis*, which is characterized by the strict, dense, and simultaneously many-flowered racemes with flowers in two opposing ranks (Luer, 1991). The only other species in the genus occurring in Brazil, *L. densiflora* and *L. floripecten*, also belong to section *Lepanthopsis* and share the characteristic raceme pattern. *Lepanthopsis vellozicola* also shares this general raceme pattern with the other species of section *Lepanthopsis*, but differs otherwise.

The secondary stem of *Lepanthopsis vellozicola* shows only two evident internodes, subtended by two leaf sheaths. The basal internodes are reduced and covered with imbricate prophylls. These prophylls are smaller and morphologically distinct from the leaf sheaths. The first leaf sheath is distal, larger, and covers almost all the secondary stem, from near its base to the leaf base, while the second one is imbricate and arises from the basal portion of the secondary stem to reach approximately the midpoint of the first sheath. In the new species, inflorescences can arise successively from the apex of the same secondary stem for several years, but only one inflorescence is produced each year.

The species of *Lepanthopsis* known to occur in Brazil can be recognized by the following key.

KEY TO THE SPECIES OF *LEPANTHOPSIS* IN BRAZIL

1a. Plant epiphytic exclusively on *Vellozia*; margins of leaf sheaths of the secondary stem smooth; secondary stem to 4 mm long, with only two internodes evident; lateral sepals completely connate . . . . . *L. vellozicola*

1b. Plant epiphytic but not observed on *Vellozia*; margins of leaf sheaths of the secondary stem scabrous or ciliate; secondary stem 4 mm long or longer, with at least three internodes evident; lateral sepals connate to near the apex.

  2a. Sheath margins of the secondary stem scabrous; leaves narrowly elliptic; lateral sepals to 1.5 mm long, ovate, connate to the midpoint or nearly so; apex of the lateral sepals acute; corolla lip ovate. . . . . *L. densiflora*

  2b. Sheath margins of the secondary stem ciliate; leaves oblong to elliptic; lateral sepals at least 3.5 mm long, oblong, connate nearly to the apex; apex of the lateral sepals obtuse; corolla lip suborbicular . . . . . *L. floripecten*

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Una Nueva Combinación en *Hofmeisterella* (Orchidaceae) para la Flora de Colombia

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Resumen. En el presente trabajo, proponemos la nueva combinación *Hofmeisterella falcata* (Linden & Reichenbach f.) Nauray & A. Galán para la flora colombiana. Esta especie difiere de *H. eumicroscopica* (Reichenbach f.) Reichenbach f. por sus flores con sépalos y pétalos más anchos y por el ginostemo y el labelo con cerdas conspicuas. En consecuencia, el género *Hofmeisterella* Reichenbach f. está formado por dos especies, y no es un género monoespecífico. Además, se designa formalmente el lectotipo de *Telipogon falcatus* Linden & Reichenbach f.

Abstract. In this work, we propose the new combination *Hofmeisterella falcata* (Linden & Reichenbach f.) Nauray & A. Galán for use in the Colombian flora. This species differs from *H. eumicroscopica* Reichenbach f. by its flowers with wider sepals and petals and by its column and labellum with conspicuous bristles. Consequently, the genus *Hofmeisterella* Reichenbach f. consists of two species and is no longer a monospecific genus. Moreover, the lectotype of *Telipogon falcatus* Linden & Reichenbach f. is formally designated.

Key words: Colombia, *Hofmeisterella*, Orchidaceae, *Telipogon*.

Hofmeisterella Reichenbach f. es un género sudamericano que se caracteriza por sus hojas en forma de abanico, equitantes, ensiformes, y el pedúnculo ancipital, angostamente bialado; las flores presentan los pétalos y sépalos similares, reflejos, el labelo triangular-lanceolado, cordiforme, acuminado, y el ginostemo en una larga columna que finaliza en un rostelo recurvado (Schweinfurth, 1960; Foldats, 1970; Dodson & Bennett, 1989). Hasta el momento se consideraba formado por una sola especie, *H. eumicroscopica* Reichenbach f., de amplia distribución en los bosques montanos húmedos de América del Sur (Brako & Zarucchi, 1993; Jørgensen & León-Yáñez, 1999).

Durante el estudio del género *Telipogon* Kunth en el Perú (Nauray Huari & Galán de Mera, 2008), y tras la revisión de los pliegos del género conservados en W, hemos encontrado un ejemplar procedente de Colombia etiquetado como *T. falcatus* Linden & Reichenbach f. (Fig. 1), acompañado de un pliego (*H. G. Reichenbach 30500*, W) con los dibujos

Tabla 1. Comparación entre *Hofmeisterella* (*H. eumicroscopica*, *H. falcata*) y *Telipogon*.

	Hofmeisterella	*Telipogon*
Hojas	ensiformes; equitantes, formando un abanico	lanceoladas a ovadas; esparcidas
Pedúnculo	ancipital en toda su longitud	triquetro o cilíndrico en la base
Pétalos	lineales o lanceolados, falcados	elípticos a rotundos, algunas veces más anchos que largos
Labelo	triangular-lanceolado; cordiforme	elíptico a rotundo, varias veces más ancho que largo; cuneado

Tabla 2. Comparación entre *Hofmeisterella eumicroscopica* y *H. falcata*.

	H. eumicroscopica	*H. falcata*
Sépalos	0.6–0.8 mm ancho; lineales	ca. 3 mm ancho; triangular-lanceolados
Pétalos	0.6–0.8 mm ancho; lineales; 1 nervio	ca. 3 mm ancho; lanceolados; 3 nervios
Labelo	glabro	con cerdas
Ginostemo	glabro	con cerdas

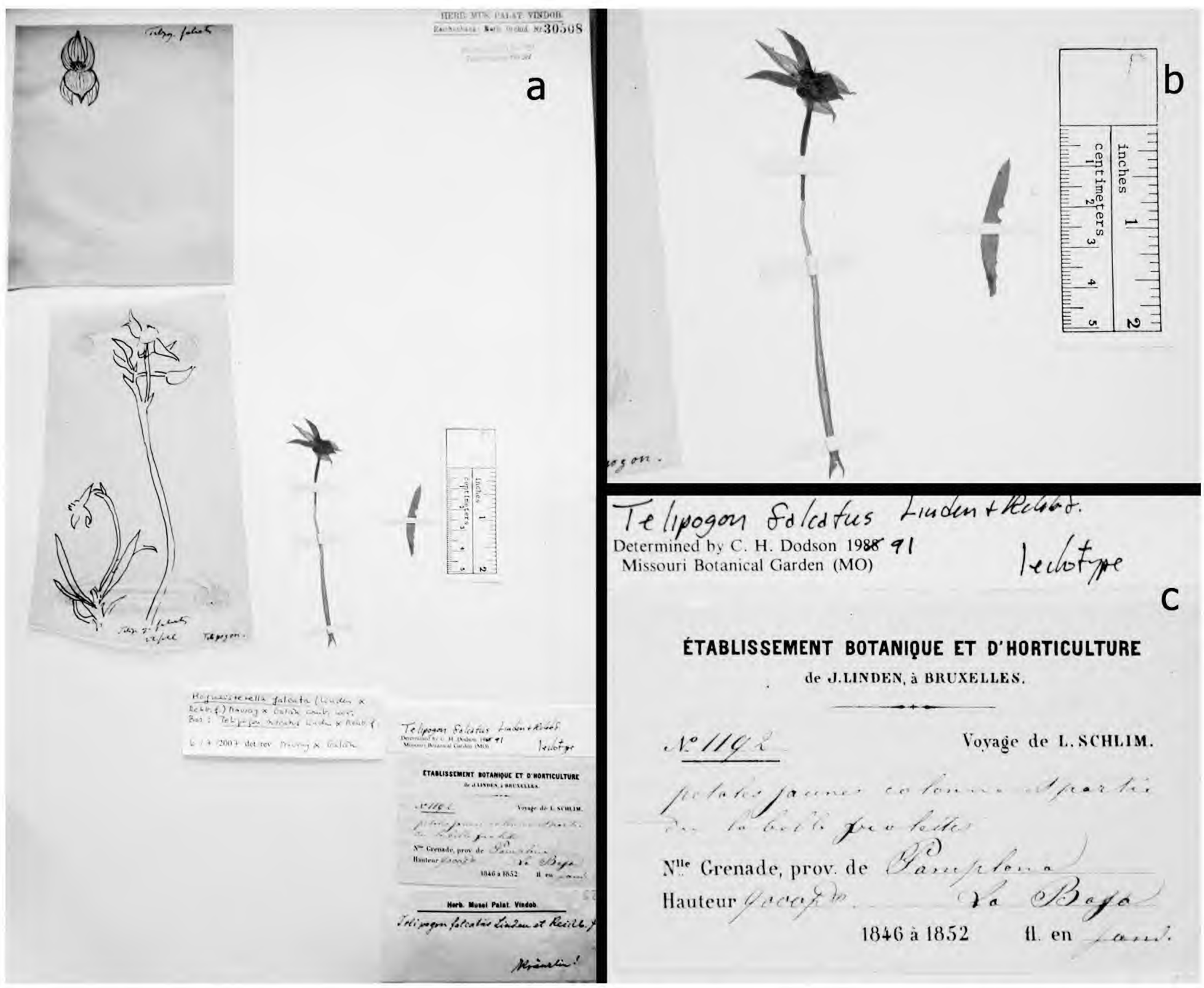

Figura 1. *Telipogon falcatus* Linden & Reichenbach f. (*J. Linden 1192*, lectotipo [W]). —a. Pliego de herbario completo. —b. Detalle de la flor, pedúnculo y hoja. —c. Detalle de las etiquetas.

utilizados por los autores para la descripción de la especie (Fig. 2). Además, en el pliego con el ejemplar figura una etiqueta manuscrita por Dodson en 1991 indicando el lectotipo de *T. falcatus*, aunque no lo designó formalmente (Dodson, in litt.).

El ejemplar presenta el pedúnculo ancipital, las flores con sépalos y pétalos lanceolados y muy agudos, el labelo triangular-lanceolado y acuminado, y el ginostemo alargado, ambos con cerdas. Estos caracteres coinciden con el protólogo (Reichenbach, 1854) y vuelven a aparecer en el pliego ilustrado, donde además se puede observar la disposición y forma de las hojas, y una gran cantidad de cerdas agudas en el labelo y el ginostemo. La morfología tanto de las partes vegetativas como de la flor y la disposición de sus piezas, nos lleva a separar esta planta de *Telipogon* (Tabla 1) y proponer una combinación dentro del género *Hofmeisterella*. Por tanto, *Hofmeisterella* deja de ser monoespecífico y consta de dos especies, las cuales se diferencian por la forma de los pétalos y sépalos, y la presencia de cerdas en el labelo y ginostemo (Tabla 2).

1. **Hofmeisterella eumicroscopica** Reichenbach f., Ann. Bot. Syst. (Walpers) 3: 563. 1852. TIPO: [Ecuador.] Loxa: 9000 ft., *Warcewicz s.n.* (holotipo, W [*H. G. Reichenbach 31005*]).

Especímenes examinados. PERÚ. **Amazonas:** Chachapoyas Province, Rodríguez de Mendoza, Cochamal, localidad "Tinas", Montaña de Yanamonte, 2000 m, 3 jul. 1991, *C. Díaz, L. Campos, O. Culquimboz & G. Vilca 4524* (USM). **Cusco:** Paucartampo, alrededores de Pillahuata, 2400 m, *D. Moscoso Z. & Y. M. B. 922* (CUZ).

2. **Hofmeisterella falcata** (Linden & Reinchenbach f.) Nauray & A. Galán, comb. nov. Basiónimo: *Telipogon falcatus* Linden & Reichenbach f., Bonplandia 2: 280. 1854. TIPO: N^lle Grenade [Colombia]. Pamplona: La Baja, 9000 ft.,

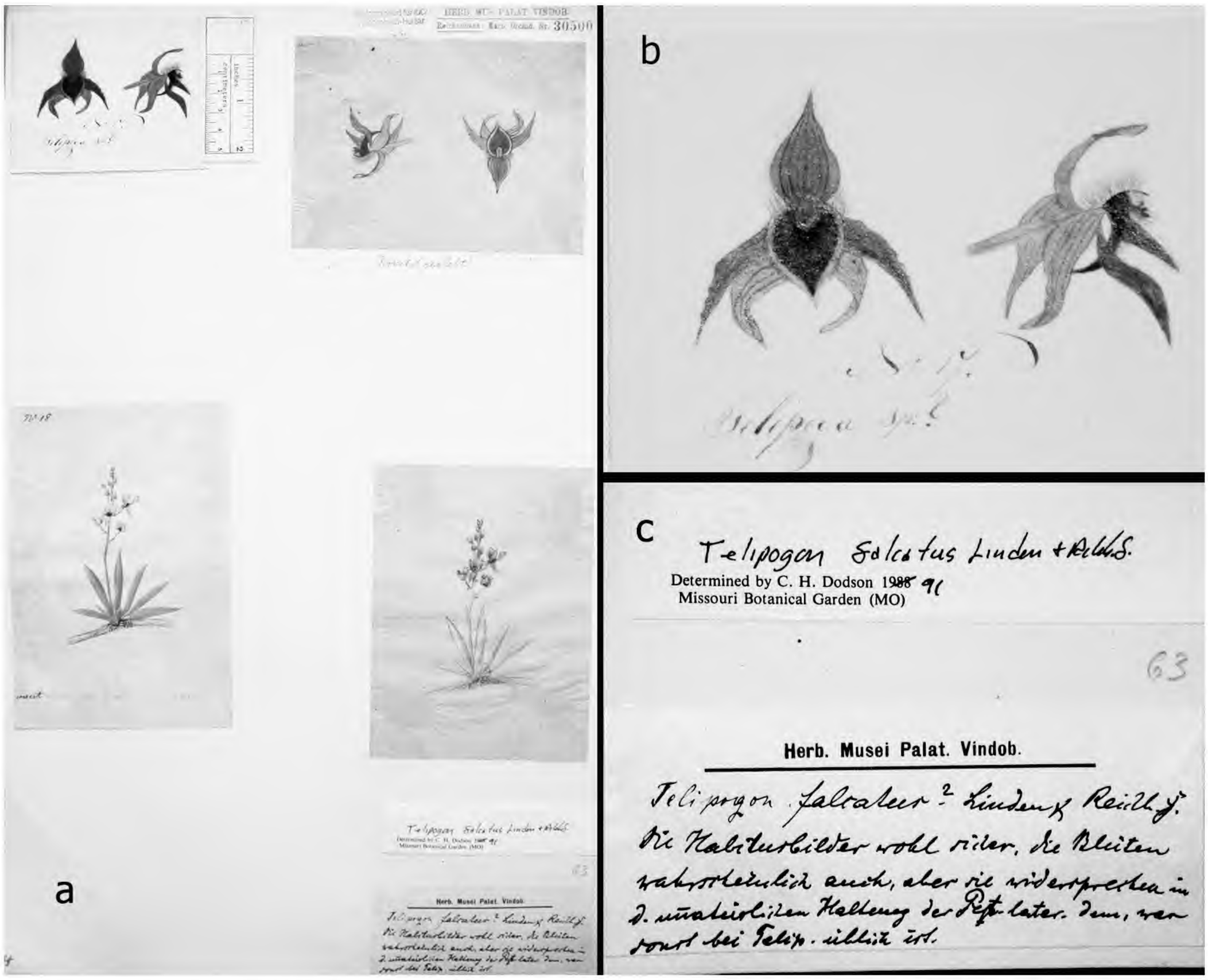

Figura 2. Ilustraciones de *Telipogon falcatus* Linden & Reichenbach f. (*H. G. Reichenbach 30500*, W). —a. Pliego de herbario completo. —b. Detalle de la flor. —c. Detalle de las etiquetas.

jan. 1846 à 1852 (fl.), *J. Linden 1192* (lectotipo, designado aquí, W [*H. G. Reichenbach 30508*]).

Especímenes examinados. COLOMBIA. Sep. 1974, *K. Senghas s.n.* (RENZ [fotos 601819, 601820]).

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Two New Combinations in *Arisaema* (Araceae) from India

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Abstract. Taxonomic and palynological studies on *Arisaema* Martius (Araceae) from the Western Ghats, India, distinguish two taxa belonging to section *Tortuosa* Engler. *Arisaema sahyadricum* S. R. Yadav, K. S. Patil & Bachulkar var. *ghaticum* Sardesai, S. P. Gaikwad & S. R. Yadav, a recently described variety in 2006, is treated here at the species level as *A. ghaticum* Punekar & Kumaran. *Arisaema sivadasanii* S. R. Yadav, K. S. Patil & Janarthanam, previously considered as a synonym of *A. tortuosum* (Wallich) Schott, is recognized here as the subspecies *A. tortuosum* subsp. *sivadasanii* (S. R. Yadav, K. S. Patil & Janarthanam) Punekar & Kumaran. Taxonomic implications are discussed and a key to the *Arisaema* taxa of the North Western Ghats is provided.

Key words: Araceae, *Arisaema*, India, IUCN Red List, pollen morphology.

The genus *Arisaema* Martius (Araceae) comprises ca. 170 species (Mayo et al., 1997), 210 species (Govaerts & Frodin, 2002), or ca. 150 species (Gusman & Gusman, 2002). In addition, Govaerts and Frodin (2002) recognized nine subspecies and 24 varieties, while Gusman and Gusman (2002) recognized 12 subspecies, eight varieties, and two forms. The genus extends from Central and East Africa to Southeast Asia, including Yemen, Oman, Pakistan, Afghanistan, the Himalayan ranges, and India, as well as China, Korea, Japan, Siberia, and into North America. In India, the genus has 44 species and nine varieties (Karthikeyan et al., 1989), 38 species and six varieties (Govaerts & Frodin, 2002), or 36 species, one subspecies, one variety, and one form (Gusman & Gusman, 2002). At present, the North Western Ghats in India have six species, one subspecies, and two varieties (including the combinations herein), of which three taxa are endemic to this area, i.e., *A. ghaticum* Punekar & Kumaran, *A. murrayi* (J. Graham) Hooker var. *sonubeniae* P. Tetali, Punekar & Lakshminarasimhan, and *A. sahyadricum* S. R. Yadav, K. S. Patil & Bachulkar (Punekar & Kumaran, 2005). During floristic studies on the genus *Arisaema* of the North Western Ghats, an interesting *Arisaema* was collected, which, after study of relevant literature (Engler, 1920; Sivadasan, 1982; Yadav et al., 1993, 1997; Lakshminarasimhan, 1996; Sasikala, 2000; Mishra & Singh, 2001; Gusman & Gusman, 2002; Tetali et al., 2004; Sardesai et al., 2006), comparison with herbarium collections at BSI and CAL, and our own field observations, was identified as the recently described *A. sahyadricum* var. *ghaticum* Sardesai, S. P. Gaikwad & S. R. Yadav (2006). However, these plants that are referable to *A. sahyadricum* var. *ghaticum* should be recognized at the specific level, as the taxon differs from the allied species *A. murrayi* and *A. sahyadricum* (Figs. 1C, D; 2C, D) in many characters, including spathe color, the slender appendage that is well exserted and curved downward and back again, and pollen morphology. Comparison of morphological and pollen characters of *A. ghaticum* with its allied species is provided in Table 1.

Materials used in the present study were collected from the Sinhagad, Mahabaleshwar, and Amboli areas in the North Western Ghats. Voucher specimens are deposited at the Herbarium of the Agharkar Research Institute, Pune, India (AHMA). Voucher material for pollen studies may be found at the repository of the Paleobiology Group, Agharkar Research Institute, Pune, India (Palaeo. Agharkar Res. Inst.).

Pollen grains for SEM study were collected from fresh anthers and prepared by the method proposed by Juniper et al. (1970) with slight modifications. Pollen grains were fixed with 2% glutaraldehyde, rinsed in distilled water, and then dehydrated through an acetone series. This was followed by critical-point drying, gold coating (JFC-1600 Auto Fine Coater; JEOL Datum Ltd., Tokyo, Japan), and examination under a JEOL-6360A analytical scanning electron microscope (JEOL Datum Ltd.) in the Department of Physics, University of Pune. The terminology applied for pollen grains generally follows that of Erdtman (1966) and Kremp (1968).

New Combinations in *Arisaema*

1. **Arisaema ghaticum** (Sardesai, S. P. Gaikwad & S. R. Yadav) Punekar & Kumaran, comb. et stat. nov. Basionym: *Arisaema sahyadricum* S. R. Yadav, K. S. Patil & Bachulkar var. *ghaticum* Sardesai, S. P. Gaikwad & S. R. Yadav, Rheedea 16: 45. 2006. TYPE: India. Maharashtra: Kas, 26

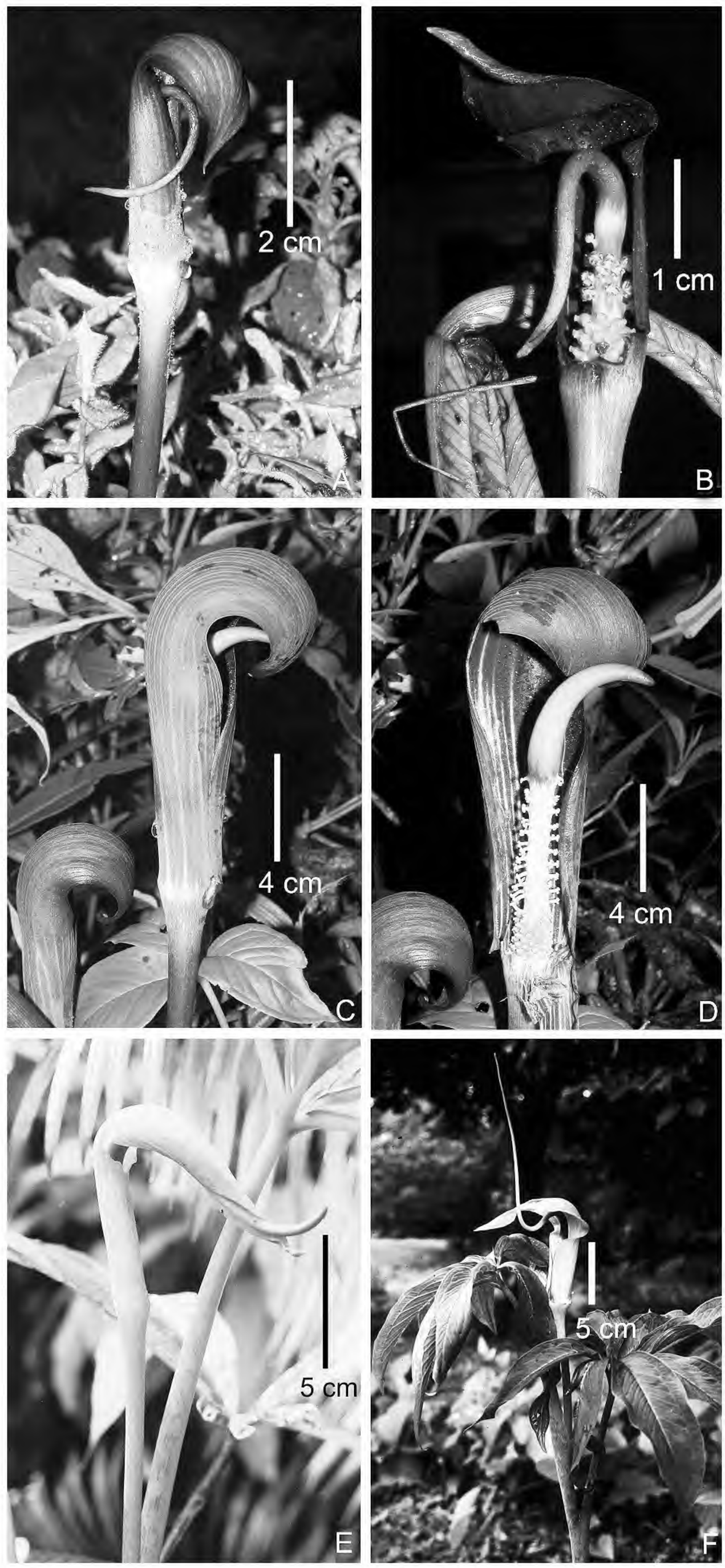

Figure 1. A, B. *Arisaema ghaticum* (Sardesai, S. P. Gaikwad & S. R. Yadav) Punekar & Kumaran. —A. Inflorescence. —B. Spathe cut open to show androgynous spadix. C, D. *A. sahyadricum*. —C. Inflorescence. —D. Spathe cut open to show androgynous spadix. —E. *A. tortuosum* subsp. *sivadasanii* (S. R. Yadav, K. S. Patil & Janarthanam) Punekar & Kumaran, inflorescence. —F. *A. tortuosum* subsp. *tortuosum*, inflorescence. Photos by S. A. Punekar.

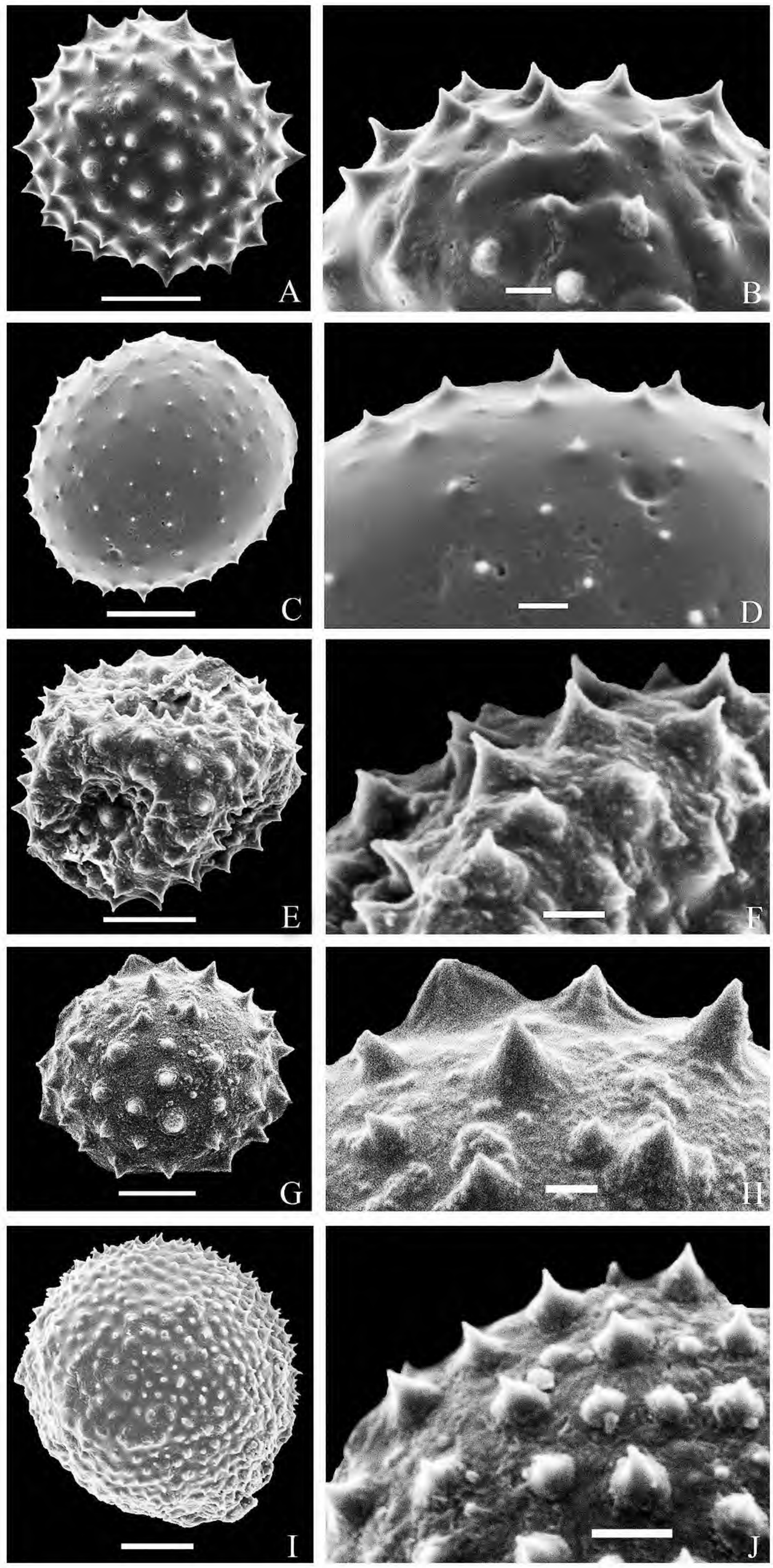

Figure 2. SEM image of pollen. A, B. *Arisaema ghaticum* (Sardesai, S. P. Gaikwad & S. R. Yadav) Punekar & Kumaran. —A. Pollen. —B. Enlarged sector showing the echinae. C, D. *A. sahyadricum*. —C. Pollen. —D. Enlarged sector showing the echinae. E, F. *A. tortuosum* var. *tortuosum*. —E. Pollen. —F. Enlarged sector showing the echinae. G, H. *A. tortuosum* var. *neglectum*. —G. Pollen. —H. Enlarged sector showing the echinae. I, J. *A. tortuosum* subsp. *sivadasanii* (S. R. Yadav, K. S. Patil & Janarthanam) Punekar & Kumaran. —I. Pollen. —J. Enlarged sector showing the echinae. Scale bars: A, C, E, G, I = 5 μm; B, D, F, H, J = 1 μm.

Table 1. Comparative morphological characters of *Arisaema ghaticum* with its allied species.

	A. ghaticum	*A. sahyadricum*	*A. murrayi*
Inflorescence	emergence before the leaves unfold	emergence along with leaf	emergence before the leaves unfold
Spathe	≤ 6 cm	7–13 cm	6.5–15 cm
Spathe tube	mauve to greenish brown, without any vertical white striations	reddish purple, with white vertical striations	green entirely or in lower half, white or purple in upper half, with paler longitudinal stripes
Spathe limb	curved downward, mauve to greenish brown, without any vertical white stripes	curved downward, reddish purple with pale stripes	almost at right angles to spathe tube, white, light purple, or lavender with translucent veins and a cherry-red cross band at the base inside
Appendix	well exserted from spathe, curved downward and back again	included in spathe, curved	included in spathe, curved, S-shaped
Anther	anther connectives with 2 to 4 elongated, conical processes	anther connectives with 2 to 4 elongated, conical processes	anther connectives without any processes
Pollen	echinae or spinules comparatively dense, ca. 8 per 5 μm^2, pollen surface psilate, undulating	echinae or spinules sparse, ca. 6 per 5 μm^2, pollen surface psilate	echinae or spinules sparse, ca. 4 to 6 per 5 μm^2, pollen surface psilate or perforate

May 1997, *M. M. Sardesai 394* (holotype, CAL; isotypes, BLAT, BSI, CALI, K, Dept. Bot. Shivaji Univ., Kolhapur). Figures 1A, B; 2A, B.

Distribution and habitat. At Sinhagad, the plants grow at altitudes of 1200–1400 m in rock crevices, near boulders, on steep grassy hillsides, and also in well-exposed soil-covered basaltic plateaus in association with *Arisaema murrayi*, *Begonia concanensis* A. DC., *Curculigo orchioides* Gaertner, *Heracleum grande* (Dalzell & A. Gibson) P. K. Mukhopadhyay, *Hypoxis aurea* Loureiro, *Impatiens dalzellii* Hooker f. & Thomson, *Sonerila scapigera* Dalzell, and *Typhonium venosum* (Dryander ex Aiton) Hetterscheid & P. C. Boyce. It has been observed in Sinhagad that an unidentified snail species forages only on reproductive parts like the spathe, spadix, and appendage, causing a natural threat to the population of *A. ghaticum*. At the Kas Plateau, it grows in association with *A. murrayi*, *Ceropegia jainii* Ansari & B. G. Kulkarni, *Curculigo orchioides*, *Curcuma neilgherrensis* Wight, *Hypoxis aurea*, *Iphigenia stellata* Blatter, *Ledebouria revoluta* (L. f.) Jessop, and *Peristylus densus* (Lindley) Santapau & Kapadia. The population at Mahabaleshwar grows at an altitude of 1100–1200 m in shady roadside trenches on the outskirts of semi-evergreen forests dominated by *Catunaregam spinosa* (Thunberg) Tirvengadum, *Memecylon umbellatum* Burman f., and *Syzygium cumini* (L.) Skeels.

Phytogeography and endemism. The species is locally endemic in the North Western Ghats from Sinhagad to the Mahabaleshwar region.

IUCN Red List category. The population size is estimated to be fewer than 250 mature individuals, while the population at each location mentioned above is likely to contain fewer than 50 mature individuals. This population is currently under severe threat due to decline in quality of habitat (habitat conversion, construction of windmills on lateritic plateau, road widening, and landslides) and herbivores. If such threats continue, the population size may be reduced to less than 80% within the next 10 years. Therefore, after applying IUCN (2001) criteria, the species is categorized as Critically Endangered (CR).

Phenology. Flowering starts usually in mid-May or in the first week of June (as soon as the mist sets on the hills during the pre-monsoon showers); fruiting extends from June to July.

Relationships. *Arisaema ghaticum* is allied to *A. murrayi* and *A. sahyadricum* and clearly belongs to section *Tortuosa* Engler (sensu Murata, 1984, 1990) because of its lamellate spadix appendix and 5-carpellate ovaries. A comparative account of morphological and pollen characters is given in Table 1.

Representative specimens examined. INDIA. **Maharashtra:** Pune Distr., Sinhagad peak, *S. A. Punekar 188635* (AHMA, BSI), *S. A. Punekar 4703, 4709* (Paleobio. Agharkar Res. Inst.); Satara Distr., Mahabaleshwar to Ambenali Ghat rd., Met-tale village, *S. P. Kavade & S. A. Punekar 188685* (Paleobio. Agharkar Res. Inst.), *S. A. Punekar 4857* (Paleobio. Agharkar Res. Inst.).

2. Arisaema tortuosum (Wallich) Schott subsp. **sivadasanii** (S. R. Yadav, K. S. Patil &

Table 2. Comparative morphological characters of *Arisaema tortuosum* subsp. *sivadasanii* with its allied taxa.

	A. tortuosum subsp. *sivadasanii*	*A. tortuosum* var. *tortuosum*	*A. tortuosum* var. *neglectum*
Leaf	solitary	2	solitary
Inflorescence	emergence after the leaf, not overtopping the leaf	emergence after the leaf, overtopping the leaf	emergence along with leaf, not overtopping the leaf
Appendix	short, thick, projects only slightly out of the spathe limb	longer and long-exserted out of the spathe limb tapering like a sigmoidally curved rat tail	longer and long-exserted out of the spathe limb tapering like a sigmoidally curved rat tail
Pollen	echinae or spinules comparatively dense, ca. 20 per 5 μm², having bulbous base	echinae or spinules sparse, ca. 6 per 5 μm², having bulbous base	echinae or spinules sparse, ca. 4 to 6 per 5 μm², without bulbous base

Janarthanam) Punekar & Kumaran, comb. et stat. nov. Basionym: *Arisaema sivadasanii* S. R. Yadav, K. S. Patil & Janarthanam, Aroideana 20: 53. 1997 [1998]. TYPE: India. Maharashtra: Amboli, 10 Sep. 1995, *S. R. Yadav 4688* (holotype, CAL; isotype, Dept. Bot. Shivaji Univ., Kolhapur not seen). Figures 1E; 2I, J.

Gusman and Gusman (2002) treated *Arisaema sivadasanii* as a synonym of *A. tortuosum* and considered it a late-flowering (from August to October) South Indian form of the polymorphic species *A. tortuosum*. Although morphological characters generally show that *A. tortuosum* subsp. *sivadasanii* is similar to *A. tortuosum* var. *tortuosum* and *A. tortuosum* var. *neglectum* (Schott) Fischer, it differs in having a short thick appendage that projects only slightly from the spathe limb (Fig. 1E) and by its late, prolonged flowering. It also differs from *A. tortuosum* var. *tortuosum* in possessing a usually solitary leaf. In varieties *tortuosum* and *neglectum*, the appendage is longer and long-exserted tapering like a sigmoidally curved rat tail (Fig. 1F). Palynogically, too, there are differences in the pollen exine structure and sculpture (Fig. 2E–J).

Distribution and habitat. This subspecies grows along roadsides in the shade of semi-evergreen forests in association with *Allophylus cobbe* (L.) Raeuschel, *Arisaema sahyadricum*, *A. tortuosum* var. *tortuosum*, *Dimorphocalyx ramiflorus* (J. Graham) M. R. Almeida, *Gynura biflora* (Burman f.) Merrill, *Luvunga eleutherandra* Dalzell, and *Mallotus stenanthus* Müller Argoviensis.

Phytogeography and endemism. This subspecies is so far known to be endemic to the North Western Ghats, from Chandoli Wildlife Sanctuary in Maharashtra to Molem National Park in Goa State.

IUCN Red List category. This subspecies has an area of occupancy estimated to be less than 20,000 km², with a severely fragmented population at fewer than 10 locations. The population size is estimated to be fewer than 10,000 mature individuals, and no subpopulation is estimated to contain more than 1000 mature individuals. This population is currently under severe threat due to decline in quality of habitat (habitat conversion and road widening) and forest management operations like weeding. If such threats continue, the population size may be reduced to a greater extent in the near future. Therefore, after applying IUCN (2001) criteria, the subspecies is categorized as Vulnerable (VU).

Phenology. Flowering season ranges from August to October; fruiting extends from late October to November.

Relationships. *Arisaema tortuosum* subsp. *sivadasanii* is allied to *A. tortuosum* var. *tortuosum* and *A. tortuosum* var. *neglectum* (all belong to section *Tortuosa*). A comparative account of morphological and pollen characters is given in Table 2.

Representative specimens examined. INDIA. **Maharashtra:** Amboli, *S. R. Yadav 4695B* (BSI); Amboli to Chokul rd., *S. A. Punekar 5110* (Palaeobio. Agharkar Res. Inst.).

KEY TO THE TAXA OF *ARISAEMA* OF THE NORTH WESTERN GHATS

1a. Appendage well exserted from the spathe.
  2a. Flowering commences before leaves appear; appendage curved downward and back again . . . . . *A. ghaticum*
  2b. Flowering commences only after leaves appear; appendage sigmoidally curved upward or S-curved.
    3a. Leaves usually 2; inflorescence overtopping the leaves . . . . . *A. tortuosum* var. *tortuosum*
    3b. Leaf solitary; inflorescence not overtopping the leaf.
      4a. Appendage long (17–19.5 cm), thinner (0.4–0.5 cm), far exserted beyond the spathe limb, tapered sigmoidally . . . . . *A. tortuosum* var. *neglectum*
      4b. Appendage short (10–15 cm), thicker (0.8–1 cm), slightly projecting out of the spathe limb, S-shaped . . . . . *A. tortuosum* subsp. *sivadasanii*
1b. Appendage included within the spathe.

5a. Leaflets radiate; appendage included in spathe tube, rounded at apex.
  6a. Inflorescence not overtopping the leaf; spathe without white or purple stripes; appendage smooth at apex . . . . . *A. caudatum* Engler
  6b. Inflorescence overtopping the leaf; spathe striped externally with white or purple; appendage rugose at apex . . . . . *A. leschenaultii* Blume
5b. Leaflets pedate; appendage exserted from spathe tube, tapering at apex.
  7a. Appendage thick (0.4–1 cm); anther connectives with 2 to 4 elongated, conical processes . . . *A. sahyadricum*
  7b. Appendage thin (0.3–0.5 cm); anther connectives without processes.
    8a. Spathe tube cylindric, green with paler longitudinal stripes becoming white near the mouth; limb white with a cherry-red cross band at the base inside; appendix green suffused with purple . . . . . *A. murrayi* var. *murrayi*
    8b. Spathe tube tapered, purple-lavender in upper half with scarlet blotch at the base on the anterior side; limb pale purple-lavender, appendix dark purple in lower half and white in upper half . . . . . *A. murrayi* var. *sonubeniae*

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New Combinations in North American *Rosulabryum* (Bryopsida, Bryaceae)

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Abstract. For the Flora of North America Project, five species are transferred to *Rosulabryum* J. R. Spence (Bryaceae). Two weedy European species, *Bryum bornholmense* Winkelmann & R. Ruthe and *B. rubens* Mitten, are transferred based on morphology and recent molecular results, as *R. bornholmense* (Winkelmann & R. Ruthe) J. R. Spence and *R. rubens* (Mitten) J. R. Spence. The western North American endemics *B. erythroloma* (Kindberg) Syed and *B. gemmascens* Kindberg are also transferred to *Rosulabryum*, as *R. erythroloma* (Kindberg) J. R. Spence and *R. gemmascens* (Kindberg) J. R. Spence. Finally, the rare eastern North American *Brachymenium andersonii* H. A. Crum is transferred to *Rosulabryum* as *R. andersonii* (H. A. Crum) J. R. Spence. In all, 13 species of *Rosulabryum* are found in North America north of Mexico. A key to the species is included.

Key words: Brachymenium, Bryaceae, *Bryum*, mosses, North America, *Rosulabryum*.

The genus *Rosulabryum* J. R. Spence was described to accommodate those species of *Bryum* Hedwig in sections *Rosulata* Müller Hallensis and *Trichophora* Kindberg (Spence, 1996). The type species is the Australian endemic *R. albolimbatum* (Hampe) J. R. Spence, a close relative of *R. andicola* (Hooker in Kunth) Ochyra, which is widely distributed in the Southern Hemisphere, extending north through South America to the mountains of the American Southwest. These species are characterized by rosulate gametophytes, leaves that are mostly obovate with upper margins serrate, rhizoidal tubers, and peristomes that are unreduced. Superficially, the larger species of *Rosulabryum* are similar to species of *Rhodobryum* (Schimper) Limpricht. However, there are many differences between the two genera, including among others the abaxial stereid band (well developed in *Rosulabryum*, reduced or absent in *Rhodobryum*) and stolons (absent in *Rosulabryum*, present in *Rhodobryum*). Recent phylogenetic work using DNA sequence data suggests that they are not closely related (e.g., Cox & Hedderson, 2003) and has for the most part supported the concept of *Rosulabryum*. The most recent treatment of *Rosulabryum* is that for the Australian species (Spence & Ramsay, 1999, 2005). Ochyra et al. (2003) transferred 19 species of *Bryum* to *Rosulabryum*, including five known from North America. The genus is a large one, with ca. 75 to 80 species, and is especially well represented in the Southern Hemisphere.

In this paper, the species of *Rosulabryum* found in North America north of Mexico are discussed, with five additional species transferred here for the Flora of North America Project. Most *Bryum* species transferred to *Rosulabryum* have been previously monographed by Syed (1973) and Mohamed (1979) and are for the most part well accepted. Because the types of most of those found in North America have already been carefully examined by Crundwell and Nyholm (1964), Syed (1973), Mohamed (1979), Demaret and Wilczek (1982), and Wilczek and Demaret (1982), there is no need to re-examine them for the purposes of this study. Types for two poorly known western North American species, however, have been studied. Two species, *R. capillare* (Hedwig) J. R. Spence and *R. torquescens* (Bruch ex De Notaris) J. R. Spence, have already been transferred to the genus by Spence (1996) as part of the Flora of Australia Project (Spence & Ramsay, 2006). Recent molecular research has shown that *B. bornholmense* Winkelmann & R. Ruthe and *B. rubens* Mitten are apparently related to *R. capillare* (Holyoak & Pedersen, 2007) rather than to the species of the *Gemmabryum subapiculatum* (Hampe) J. R. Spence & H. P. Ramsay complex where they have recently been placed (Crundwell & Nyholm, 1964; Spence & Ramsay, 2005). This seemingly surprising result can be understood as the gametophytes of these two species are rather similar to some members of the *R. capillare* complex. Finally, the species known as *Brachymenium andersonii* H. A. Crum is transferred to *Rosulabryum* as its ecology, morphology, and distribution fit better there than in *Brachymenium* Schwägrichen.

The following transfers bring the number of species in *Rosulabryum* in North America north of Mexico to 13. In addition to the five transferred here, the following eight species are also found in the study area: *R. andicola*, *R. canariense* (Bridel) Ochyra, *R.*

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capillare, *R. elegans* (Nees) Ochyra, *R. flaccidum* (Bridel) J. R. Spence, *R. laevifilum* (Syed) Ochyra, *R. pseudocapillare* (Bescherelle) Ochyra, and *R. torquescens*.

1. **Rosulabryum andersonii** (H. A. Crum) J. R. Spence, comb. nov. Basionym: *Brachymenium andersonii* H. A. Crum, Bryologist 74: 47. 1971. TYPE: U.S.A. North Carolina: Macon Co., "Chestnut Ridge, 3 mi. NE of Highlands, on humus, moist depression in hemlock-hardwood woods," 4000 ft., s.d., *L. E. Anderson 10051* (holotype, MICH not seen).

Although most species in *Rosulabryum* are distinctly rosulate, a few have evenly foliate stems. These include among others the Neotropical *R. densifolium* (Bridel) Ochyra, the Paleotropical-Australian *R. wightii* (Mitten) J. R. Spence, and the Australian–New Caledonian *R. subfasciculatum* (Hampe) J. R. Spence. *Brachymenium andersonii*, which also has evenly foliate stems, was described from material collected in North Carolina and has not been relocated since it was first found. It is sterile, and hence its placement in the traditional genera *Bryum* and *Brachymenium* cannot be completely resolved. Crum (1971) considered the species to be related to the evenly foliate *Brachymenium speciosum* (Hooker & Wilson) Steere of Mexico and Central America, while L. E. Anderson (in Crum, 1971) considered the species to be related to *Bryum densifolium* Bridel (≡ *R. densifolium* (Bridel) Ochyra). I agree with L. E. Anderson, and in fact *R. andersonii* is morphogically very similar to *R. densifolium*, including details of the leaves and stems. Future work may ultimately show them to be conspecific. All other species in *Brachymenium* are tropical and subtropical epiphytes, typically found in montane cloud forests in the Paleotropics. They are also all rosulate. The evenly foliate stems, temperate distribution, and ecology (growing on soil) of *B. andersonii* are not found elsewhere in *Brachymenium*, but are common in *Rosulabryum*. Hence this species is transferred to *Rosulabryum*.

2. **Rosulabryum bornholmense** (Winkelmann & R. Ruthe) J. R. Spence, comb. nov. Basionym: *Bryum bornholmense* Winkelmann & R. Ruthe, Hedwigia 38(3): 120. 1899. *Bryum murale* subsp. *bornholmense* (Winkelmann & R. Ruthe) J. J. Amann, Fl. Mouss. Suisse 2: 238. 1918. *Bryum erythrocarpum* subsp. *bornholmense* (Winkelmann & R. Ruthe) Podpěra, Preslia 2: 87. 1923. *Bryum erythrocarpum* var. *bornholmense* (Winkelmann & R. Ruthe) C. E. O. Jensen, Förteckn. Skand. Växt., Moss. (ed. 2): 32. 1937. *Bryum atrovirens* subsp. *bornholmense* (Winkelmann & R. Ruthe) Wijk & Margadant, Taxon 8: 71. 1959. *Ptychostomum bornholmense* (Winkelmann & R. Ruthe) D. T. Holyoak & N. Pedersen, J. Bryol. 29: 119. 2007. TYPE: Denmark. "Auf der Insel Bornholm: Paradisbokker bei Nexö (Neksø) in einem kleinen Sphagnumsumpf auf einem schwach mit Erde bedeckten Granitblock aufgefunden," 13 July 1898, *J. Winkelmann s.n.* (holotype, BP not seen).

The recent molecular work by Holyoak and Pedersen (2007) shows that *Bryum bornholmense* and its close relative *B. rubens* are apparently closely related to *Rosulabryum capillare*. They place these and many other species in a morphologically highly variable *Ptychostomum* clade defined by molecular data only, including relatively few taxa from several different traditional genera. This clade can be interpreted as a group of genera, however; thus I have moved these species to the morphologically defined *Rosulabryum* rather than placing them in a molecularly defined *Ptychostomum* Hornschuch. Although traditionally placed in the *Bryum erythrocarpum* complex of Crundwell and Nyholm (1964), these two species are somewhat anomalous as they have serrate upper laminal margins, broad laminal cells, fairly distinct limbidia, and large tubers, all features of *Rosulabryum*. Crundwell and Whitehouse (2001) have provided several diagnostic criteria that distinguish the two species. The presence of true *R. bornholmense* in North America needs to be confirmed, as most specimens appear to be misidentified *R. rubens*, according to Crundell and Whitehouse (2001).

3. **Rosulabryum erythroloma** (Kindberg) J. R. Spence, comb. nov. Basionym: *Bryum capillare* Hedwig subsp. *erythroloma* Kindberg, Eur. N. Amer. Bryin. 2: 358. 1897. *Bryum erythroloma* (Kindberg) Syed, J. Bryol. 7: 301. 1973. TYPE: Canada. British Columbia: Cedar Hill, Apr. 1887 (fr.), *J. Macoun s.n.* (neotype, designated by Syed, 1973: 304, CAN).

This species is distributed in western North America from British Columbia to Central America. A report from Bolivia (Allen, 2002) needs to be reevaluated, as several similar species of *Rosulabryum* occur in South America. The taxon was raised to species rank by Syed (1973). *Rosulabryum erythroloma* is easily distinguished from *R. capillare* by several characters of the leaf and tubers, including its

overall red coloration, short stout leaf hairpoint, decurrent leaves, and red tubers. It generally grows at low elevations near coastlines (Syed, 1973; Spence, unpublished), although it has been found in montane areas in Central America.

4. **Rosulabryum gemmascens** (Kindberg) J. R. Spence, comb. nov. Basionym: *Bryum gemmascens* Kindberg, Eur. N. Amer. Bryin. 2: 360. 1897. TYPE: Canada. British Columbia: "Can. Vanc. isl.," 1893, *J. Macoun s.n.* (holotype, CAN).

This species is closely related to *Rosulabryum capillare*, but it differs in its orange-red tuber color (vs. brown) and the elongate evenly foliate innovations with small, somewhat imbricate leaves (vs. short rosulate innovations with contorted leaves). *Rosulabryum gemmascens* is a western North American endemic distributed from British Columbia to California.

5. **Rosulabryum rubens** (Mitten) J. R. Spence, comb. nov. Basionym: *Bryum rubens* Mitten, Hooker's J. Bot. Kew Gard. Misc. 8: 232. 1856. *Bryum erythrocarpum* subsp. *rubens* (Mitten) Dixon, Stud. Handb. Brit. Mosses 336. 1896. *Bryum murale* subsp. *rubens* (Mitten) J. J. Amann, Fl. Mouss. Suisse 2: 238. 1918. *Bryum erythrocarpum* var. *rubens* (Mitten) Podpěra, Preslia 2: 85. 1923. *Bryum radiculosum* var. *rubens* (Mitten) Margadant & During, Bekn. Fl. Ned. Blad. & Leverm. 443. 1982. *Gemmabryum rubens* (Mitten) J. R. Spence & H. P. Ramsay, Phytologia 87: 68. 2005. *Ptychostomum rubens* (Mitten) D. T. Holyoak & N. Pedersen, J. Bryol. 29: 120. 2007. TYPE: S. loc., s.d., s.n. (holotype, NY).

Rosulabryum rubens and *R. bornholmense* are closely related to *R. capillare* according to the recent molecular work of Holyoak and Pedersen (2007). Most North American material can probably be referred to *R. rubens*, based on the revisions of Crundwell and Whitehouse (2001).

Key to *Rosulabryum* of North America North of Mexico

1a. Filiform gemmae present in axils of upper innovation leaves 2
1b. Filiform gemmae absent. 5
2a. Innovations short, rosulate, leaves large, mostly > 3 mm long, distal lamina margins strongly serrate, limbidium strong . . . . . *R. andicola*
2b. Innovations rosulate or elongate and evenly foliate, leaves small, mostly < 2 mm long, distal lamina margins serrulate to almost smooth, limbidium weak or absent. 3
3a. Innovations rosulate, leaves obovate, flat, rhizoidal tubers red, filiform gemmae brown . . . . *R. laevifilum*
3b. Innovations evenly foliate, leaves ovate, concave, rhizoidal tubers various colors, filiform gemmae red, red-brown, or brown 4
4a. Rhizoidal tubers orange to pink-orange, brighter than rhizoids, filiform gemmae red. . . . . *R. pseudocapillare*
4b. Rhizoidal tubers and filiform gemmae brown. . . . . *R. flaccidum*
5a. Plants with elongate evenly foliate stems, leaves large, 2–4 mm long, distinctly decurrent, margins sharply serrate distally . . . . . *R. andersonii*
5b. Plants rosulate or if evenly foliate then leaves small, < 2 mm long, and distal margins mostly smooth or only weakly serrulate; leaves decurrent or not 6
6a. Leaves medium-sized to large, 2–4 mm long, often in 2 or more interrupted tufts, margins serrate, limbidium strong or absent distally, costa excurrent in short stout hairpoint, lamina cells incrassate, distinctly porose 7
6b. Leaves mostly < 2 mm long, usually not in interrupted tufts, variously contorted, twisted, or imbricate, margins smooth to serrulate, limbidium present or nearly absent, costa various, not reaching apex to long excurrent in long hairpoint, lamina cells thin to firm-walled, not or weakly porose. 8
7a. Distal margins of leaves lacking limbidium, leaves often in 2 or more interrupted comal tufts, hairpoint recurved when dry. . . . . *R. canariense*
7b. Distal margins of leaves with strong limbidium, leaves usually in single tufts, hairpoint variously straight to curved but not distinctly recurved. . . . . *R. andicola*
8a. Stems ± evenly foliate, julaceous, leaves not much contorted when dry, distal margins of leaves with weak or absent limbidium, rhizoidal tubers absent. . . . . *R. elegans*
8b. Stems rosulate, although innovations sometimes evenly foliate, leaves variously contorted or twisted, rarely innovations or leaves imbricate, distal margin of leaf with strong to nearly absent limbidium, rhizoidal tubers present 9
9a. Plants with strong reddish tints, leaves distinctly decurrent, costa strong in short hairpoint . . . . . *R. erythroloma*
9b. Plants green, brown-green to red-green, leaves not decurrent, hairpoint excurrent in short, medium, or long hairpoint. 10
10a. Plants polyoicous (synoicous, some shoots unisexual, others with unisexual lateral gametangia), rhizoidal tubers amber, orange, orange-red to crimson, generally lighter than rhizoids, distal leaf margins distinctly serrate, capsule often strongly nodding, red at maturity 11
10b. Plants dioicous, rhizoidal tubers red, orange-red, red-brown to brown, mostly same color as rhizoids, if brighter then tubers distinctly warty with protuberant cells, distal leaf margins serrate, serrulate to almost smooth, capsule often inclined, red-brown to brown. 12
11a. Tubers orange to amber, becoming brown with age, limbidium weak, leaves ovate. . . . . *R. bornholmense*
11b. Tubers bright red-orange to crimson, limbidium strong, leaves obovate . . . . . *R. torquescens*
12a. Tubers with distinctly protuberant cells, dark red to red-crimson, clustered at base of stem on short

rhizoids, distal lamina margins distinctly serrate, leaves irregularly contorted when dry . . . . *R. rubens*

12b. Tubers smooth or almost so, orange, red, or brown, mostly on long rhizoids away from stem base, distal lamina margins ± smooth, if serrate then leaves spirally twisted around stem when dry 13

13a. Limbidium absent or weak, margins almost smooth, innovations elongate, of imbricate ovate leaves, somewhat reddish or red-brown, rosulate leaves irregularly contorted, tubers orange-red to red . . . . . *R. gemmascens*

13b. Limbidium usually present, margins serrulate, innovations short, rosulate, green with leaves contorted, rosulate leaves twisted around stem, tubers brown-red to brown . . . . . *R. capillare*

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Una Nueva Especie Leñosa de *Cryptantha* (Boraginaceae) para la Flora de Chile

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RESUMEN. Se describe una nueva especie de *Cryptantha* Lehmann ex Fischer & C. A. Meyer (Boraginaceae), *C. marioricardiana* Teillier. Ésta tiene la particularidad de ser un arbusto caméfito, un carácter muy poco frecuente en el género. La especie crece en Chile, en la costa del desierto de Atacama (28°S), en la Región de Atacama (III).

ABSTRACT. A new species of *Cryptantha* Lehmann ex Fischer & C. A. Meyer (Boraginaceae), *C. marioricardiana* Teillier, is described. The new species is a chamaephytic shrub, a very infrequent character in the genus. This species grows in Chile, in the coastal Atacama Desert (III Region de Atacama, 28°S).

Key words: Atacama Desert, Boraginaceae, Chile, *Cryptantha*, IUCN Red List.

Se considera actualmente que *Cryptantha* Lehmann ex Fischer & C. A. Meyer (Boraginaceae), posee unas 100 especies distribuidas en Norteamérica y Sudamérica (Mabberley, 1987). Para Chile se citan unas 40 especies (Marticorena & Quezada, 1985). Plantas del género crecen además en países vecinos como Perú (unas 15 especies; Brako & Zarucchi, 1993), Bolivia y Argentina (13 especies; Zuloaga & Morrone, 1999).

Cryptantha reúne especies de hierbas anuales o perennes, hasta ahora sólo se conocía una de hábito arbustivo: *C. gnaphalioides* (A. DC.) Reiche del norte de Chile.

Las flores pueden ser casmógamas o cleistógamas, pudiendo encontrarse en un individuo sólo un tipo de ellas o ambos; cáliz unido sólo en la base; corola blanca con un tubo basal cilíndrico, corto, con o sin escamas en la garganta, lóbulos casi imbricados. Fruto, una núcula con una cicatriz ventral característica, se forman 1 a 4 por flor.

Las especies del género en Chile crecen en ambientes áridos y semi-áridos. En el norte, desde la costa del desierto de Atacama hasta la parte baja del altiplano, en el centro en ambientes de matorral y bosque esclerofilo inclusive en la estepa andina, en el sur del país son escasas y se encuentran sólo en la estepa de la Patagonia. La mayor parte de ellas son endémicas de Chile.

Cryptantha marioricardiana Teillier, sp. nov. TIPO: Chile. Región de Atacama (III): Prov. Huasco, quebrada de Carrizalillo, 28°22′S, 71°06′W, 25 Sep. 1993, *S. Teillier, L. Torres y R. Villarroel 3163* (holotipo, CONC; isotipo, SGO). Figuras 1, 2.

Haec species quoad habitum lignosum etiam nuculam laevem nitidam ad *Cryptantham gnaphaloidem* (A. DC.) Reiche maxime accedit, sed ab ea caulibus juvenilibus ac foliis viridibus (nec griseoargenteis), his subsucculentis facile distinguitur.

Especie caméfita, subarbustiva, ramificada desde cerca de la base, ramas erectas, leñosas, de hasta 20 cm de altura (Fig. 1A). Corteza de los tallos más antiguos algo cenicienta; la de los nuevos, marrón, suave e irregularmente estriada, con tricomas apegados al tallo que nacen en una base algo ensanchada. Hojas alternas, en su mayoría divergentes del tallo, con yemas o pequeños fascículos de hojas en las axilas; sésiles; láminas lineares, de ca. 10 × 2 mm, menores hacia el extremo de las ramas (ca. 5 × 2 mm), algo suculentas y cilíndricas en vivo, base poco ensanchada, tricomas en ambas caras, nacen de una pústula blanca de ca. 0.5 mm que persiste después de su caída (Fig. 1B). Inflorescencias cimosas: monocasios o ripidios, ramas de hasta 5 cm, con brácteas lineares de base ensanchada, de ca. 5 mm. Flores con pedicelos de hasta 1 mm, base densamente cubierta por tricomas híspidos, no pustulados; todas casmógamas; cáliz 5-lobulado, dividido hasta la base del tubo, sépalos híspidos, lineares, de hasta 2.5 mm, acrescentes hacia la madurez del fruto, alcanzan 4–5 mm; corola blanca, cortamente rotácea, 5-lobulada, de ca. 4(–5) × 6 mm, tubo de 2–2.5 mm, lóbulos redondeados con la base algo imbricada; garganta de la corola con un anillo de 5 glándulas amarillas ± hemisféricas y una pequeña depresión en el centro (fornículos); estambres 5, filamentos muy cortos, no sobresalen del tubo; ovario con 4 primordios seminales, estilo muy alargado y por lo menos del doble del largo que los primordios; sólo se desarrolla una núcula por ovario. Frutos triangulares, ápice agudo, base ensanchada, dorso liso, brillante y jaspeado (Fig. 1C, D); la cara ventral que

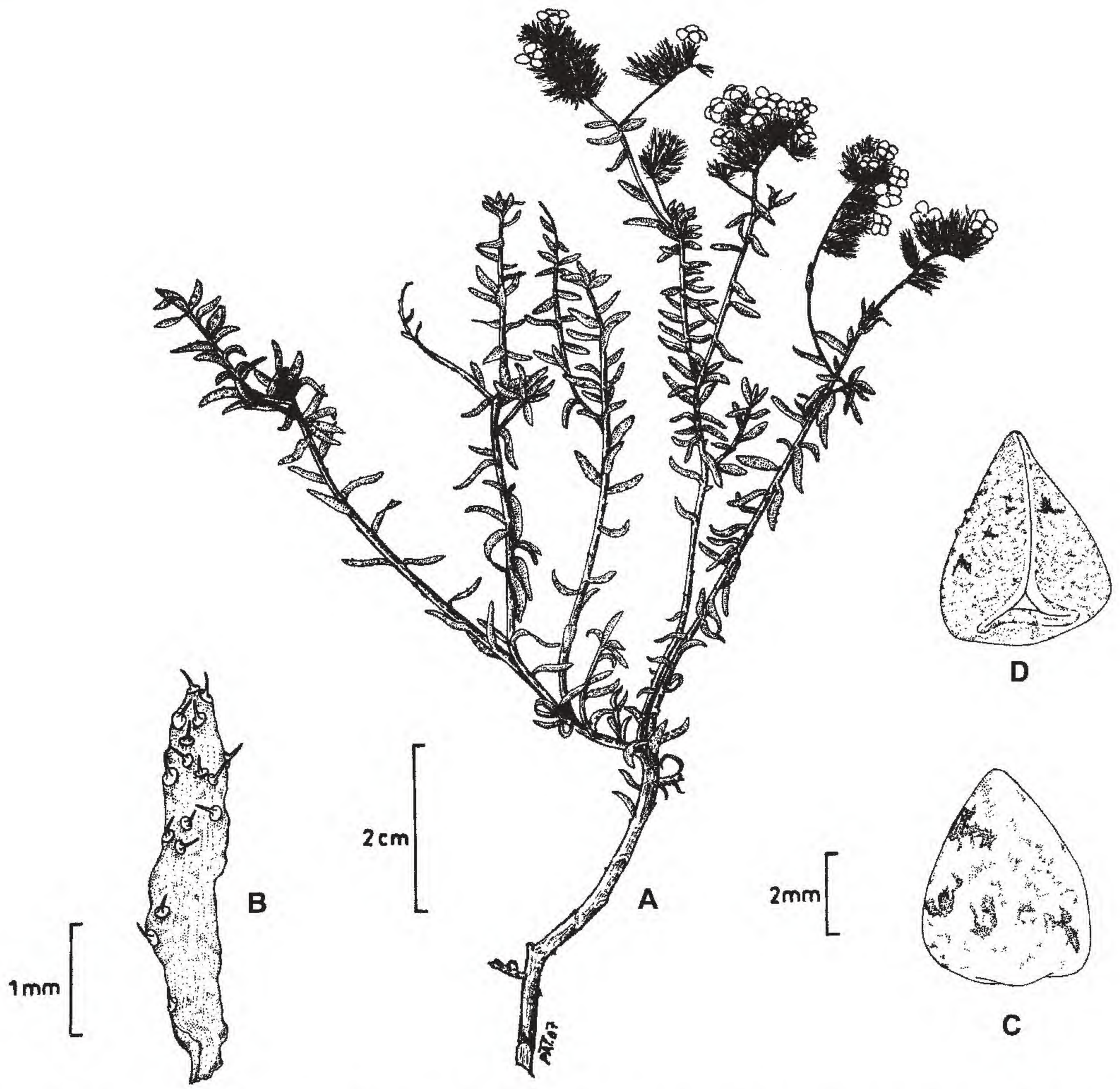

Figura 1. *Cryptantha marioricardiana* Teillier. —A. Hábito. —B. Hoja mostrando las pústulas de donde nacen los tricomas. —C, D. Núculas, vista dorsal y ventral. Dibujado del tipo *S. Teillier, L. Torres y R. Villarroel 3163* (CONC, SGO).

da hacia el estilo con una cicatriz larga y abierta que en la parte inferior forma una cavidad de ámbito triangular; bordes algo resaltados.

Distribución geográfica. Hasta ahora la especie ha sido colectada en dos localidades del litoral de la provincia de Huasco, en la costa del desierto de Atacama (Fig. 2). Crece en sitios arenosos cercanos al mar. A pesar de tener flores relativamente conspicuas comparadas con otras del género, su detección en terreno es complicada dado que probablemente desarrolla hojas y flores sólo en las temporadas en que dispone de suficiente humedad.

Desde el punto de vista de la fitogeografía, la especie participa en las asociaciones de la formación conocida como Desierto Costero del Huasco (Gajardo, 1994), que se extiende en la franja del litoral desde Caldera (27°S) hasta poco más al sur de Huasco (28°S). La fisonomía de la vegetación es de tipo matorral con arbustos frecuentemente caducifolios en verano, como *Balbisia peduncularis* (Lindley) D. Don (Ledocarpaceae), *Oxalis gigantea* Barneoud (Oxalidaceae) y *Heliotropium floridum* (A. DC.) Clos var. *latifolium* Philippi (Boraginaceae), siempreverdes como *Atriplex clivicola* I. M. Johnston, y suculentas como *Copiapoa dealbata* F. Ritter y *Eulychnia breviflora* Philippi (Cactaceae). Luebert y Pliscoff (2006) incluyen la vegetación del área en el piso del Matorral Desértico Mediterráneo Costero de *O. gigantea* y *E. breviflora*.

Conservación. De acuerdo con los criterios de conservación de la UICN (2001), *Cryptantha marioricardiana* podría ser considerada como Vulnerable (VU) debido a que apenas se la conoce en dos localidades, y debido al estrecho rango de distribu-

Figura 2. Desierto costero del Huasco, en la Región de Atacama, Chile. Vista del ambiente donde crece *Cryptantha marioricardiana* Teillier. Foto: H. Niemeyer.

ción geográfica donde crece: una franja de litoral de unos 20 km. La distribución potencial de acuerdo con la superficie del piso de vegetación propuesto por Luebert y Pliscoff (2006) sería de unos 500 km². Es importante consignar que al menos una de las poblaciones conocidas se encuentra protegida en el Parque Nacional Llanos de Challe, localidad de donde proviene el paratipo; la localidad del tipo se encuentra próxima a un área en curso de urbanización.

Etimología. Dedico esta especie al eminente botánico Mario Ricardi Salinas (1921–2005), fundador de la revista *Gayana Botánica* (1961) y director del Instituto Central de Biología de la Universidad de Concepción (Chile) entre 1968 y 1973. Exiliado en Venezuela, trabajó en la Universidad de Mérida hasta su retiro. A lo largo de su vida realizó numerosos aportes al conocimiento de la sistemática de las plantas vasculares y la fitogeografía de Chile.

Posición sistemática. *Cryptantha* pertenece a las Boraginaceae, tribu Eritrichieae. Johnston (1927) reconoce tres secciones: *Cryptantha*, *Geocarya* I. M. Johnston y *Krynitzkia* Lehmann ex Fischer & C. A. Meyer) I. M. Johnston. Dado que la nueva especie no produce flores cleistógamas, deberá ubicarse en la primera sección. En el marco de la sección, el autor propone la serie *Gnaphalioides* I. M. Johnston para aquellas especies que tengan un hábito leñoso y núculas lisas y brillantes; señala como único integrante de ella a *C. gnaphalioides*. En relación con ello, la nueva especie, al poseer ambas características, se podría incorporar a la misma serie. Ambas son, sin embargo, de aspecto notablemente diferente: *C. gnaphalioides* es una planta gris-argéntea debido a que presenta una cubierta densa de tricomas en los tallos nuevos y en las hojas, en tanto que *C. marioricardiana* es de tallos y hojas verdes; éstas, además, son algo suculentas.

Paratipo. CHILE. **Región de Atacama (III):** Prov. Huasco, Parque Nac. Llanos de Challe, litoral próximo al sector del cerro Negro, 28°10′S, 71°07′W, 14 Oct. 1997, *S. Teillier 4692* (CONC, MO).

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A New Genus and New Combinations in Australian *Villarsia* (Menyanthaceae)

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Abstract. Menyanthaceae species in Australia formerly belonging to the genus *Villarsia* Ventenat, which morphological and molecular data have shown to be paraphyletic, are provided with new combinations in *Liparophyllum* Hooker f. and the novel genus *Ornduffia* Tippery & Les: *L. capitatum* (Nees ex Lehmann) Tippery & Les; *L. congestiflorum* (F. Mueller) Tippery & Les, lectotypified here; *L. exaltatum* (Solander ex Sims) Tippery & Les; *L. exiguum* (F. Mueller) Tippery & Les; *L. lasiospermum* (F. Mueller) Tippery & Les, lectotypified here; *L. latifolium* (Bentham) Tippery & Les; *L. violifolium* (F. Mueller) Tippery & Les, lectotypified here; *O. albiflora* (F. Mueller) Tippery & Les, lectotypified here; *O. calthifolia* (F. Mueller) Tippery & Les, lectotypified here; *O. marchantii* (Ornduff) Tippery & Les; *O. parnassifolia* (Labillardière) Tippery & Les; *O. reniformis* (R. Brown) Tippery & Les; *O. submersa* (Aston) Tippery & Les; and *O. umbricola* (Aston) Tippery & Les.

Key words: Australia, *Liparophyllum*, Menyanthaceae, *Ornduffia*, *Villarsia*.

Menyanthaceae are a morphologically diverse family of aquatic and wetland plants in the order Asterales, consisting of 60 to 70 species that are distributed worldwide (Tippery et al., 2008). Two of the five genera, *Menyanthes* L. and *Nephrophyllidium* Gilg (= *Fauria* Franchet), are monotypic and restricted to the Northern Hemisphere. *Liparophyllum* Hooker f. (also monotypic) and *Villarsia* Ventenat (18 species) are found only in the Southern Hemisphere, and *Nymphoides* Séguier (40 to 50 species) is cosmopolitan in distribution.

Tournefort (1700) had recognized two genera (*Menyanthes* and *Nymphoides*) that Linnaeus (1753) combined under *Menyanthes* to include the emergent wetland species *M. trifoliata* L. and two floating-leaved species that currently are circumscribed within *Nymphoides*: *N. indica* (L.) Kuntze and *N. peltata* (S. G. Gmelin) Kuntze. Séguier (1754) validly published *Nymphoides* subsequently; however, the later synonym *Limnanthemum* S. G. Gmelin (1769) remained the accepted genus name for over 100 years (Grisebach, 1845; Mueller, 1875; Bentham & Hooker, 1876). Ventenat (1803) later segregated another genus, *Villarsia*, to accommodate the distinct South African species *V. capensis* (Houttuyn) Merrill.

Over the next century, many species were transferred between *Limnanthemum* and *Villarsia*, particularly in Australia, where taxa with either floating-leaved or emergent habit occur. Menyanthaceae species in Australia initially were designated under *Villarsia* (Brown, 1810; Don, 1837; Endlicher et al., 1837; Lehmann, 1845), although some were included under *Menyanthes* (Sims, 1807, 1810) or the gentianaceous genus *Swertia* L. (Labillardière, 1804–1805). In a comprehensive treatment of Menyanthaceae, Grisebach (1845) listed species of both *Limnanthemum* and *Villarsia* in Australia and provided morphological characters to distinguish the genera, including epipetalous glands, capsule dehiscence, floating leaves, and inflorescence architecture. However, Grisebach recognized only two species of Menyanthaceae in Australia, *L. geminatum* (R. Brown) Grisebach (= *Nymphoides geminata* (R. Brown) Kuntze) and *V. parnassifolia* (Labillardière) R. Brown. Many additional Australian species were designated subsequently by Mueller, under both *Limnanthemum* (Mueller, 1854, 1858) and *Villarsia* (Mueller, 1860, 1865, 1868). After noting that few characters could distinguish the genera, Mueller eventually transferred every menyanthaceous species in Australia to *Limnanthemum* (Mueller, 1875), including *Liparophyllum gunnii* Hooker f., an anomalous species for which Hooker (1847) had established a separate genus.

Other authors, however, maintained the independence of *Liparophyllum* and established the boundary between *Limnanthemum* and *Villarsia* out of which current generic circumscriptions developed (Bentham & Mueller, 1869; Bentham & Hooker, 1876). The few characters that were used to distinguish between *Limnanthemum* and *Villarsia* included capsule dehiscence and inflorescence morphology, and *Liparophyllum* was differentiated by linear leaves and a lack of carpellary glands. Later, Kuntze (1891) further codified the assignment of species to genera when he transferred nearly all currently recognized species

in Australia to either *Nymphoides* or *Renealmia* Houttuyn (a *Villarsia* synonym and later homonym of *Renealmia* L. f.). Recent authors have maintained the separation of *Nymphoides* and *Villarsia* on morphological grounds that include vegetative habit and inflorescence architecture, and have supported the independence of *Liparophyllum*, which is unique among Menyanthaceae in having solitary flowers and linear leaves (Aston, 1973; Chuang & Ornduff, 1992; Cook, 1996).

Divisions among Menyanthaceae genera have been upheld in part because of their relatively discrete geographic ranges. Although *Nymphoides* species are found worldwide and *Villarsia* are relatively abundant in the Southern Hemisphere, there are few areas where both genera co-occur. Species of *Nymphoides* are absent from southwestern Australia, where over half of *Villarsia* species are endemic (Aston, 1973). In addition, *Menyanthes* and *Nephrophyllidium* are restricted to the Northern Hemisphere, which precludes any overlap in range with the Southern Hemisphere genera *Liparophyllum* and *Villarsia* (Cook, 1996).

Despite the general geographic and morphological distinctness of Menyanthaceae genera, several species of different genera are remarkably similar in their floral and seed morphology, which often have been considered as diagnostic (Grisebach, 1845; Aston, 1969; Chuang & Ornduff, 1992). Flowers in Menyanthaceae are yellow or white (rarely tinged with purple) and have either a dense covering of hair, e.g., *Menyanthes trifoliata*, *Nymphoides indica*, *Villarsia submersa* Aston, or lateral petal wings, e.g., *Nephrophyllidium crista-galli* (Menzies ex Hooker) Gilg, *Nymphoides cristata* (Roxburgh) Kuntze, *Villarsia capensis* (Tippery et al., 2008). Large seeds with smooth, elongate epidermal cells distinguish *Menyanthes* and *Nephrophyllidium* from the other genera, which have smooth to tuberculate seed surfaces that may be ornamented with trichomes, e.g., *Nymphoides peltata*, *Villarsia exaltata* (Solander ex Sims) G. Don, or a nutritive caruncle, e.g., *Nymphoides subacuta* Aston, *Villarsia latifolia* Bentham (Chuang & Ornduff, 1992). Although the distinctness of *Menyanthes* and *Nephrophyllidium* from the remainder of Menyanthaceae has been confirmed repeatedly (e.g., Nilsson, 1973; Chuang & Ornduff, 1992), morphological boundaries among the other genera have been obscured by a number of overlapping character states.

Phylogenetic analyses of the Asterales, conducted using both morphological and molecular data, have consistently resolved Menyanthaceae as monophyletic, within which *Menyanthes* and *Nephrophyllidium* are the sister clade to the remainder of the family (Olmstead et al., 2000; Soltis et al., 2000; Lundberg & Bremer, 2003). An analysis of Menyanthaceae taxa using only morphological data (including pollen, seed, and flavonoid data) resolved the floating-leaved genus *Nymphoides* as monophyletic, except for *N. exigua* (F. Mueller) Kuntze, which lacks floating leaves (Tippery et al., 2008). In the same study, *Villarsia* resolved as a paraphyletic grade toward *Nymphoides*, and *Liparophyllum* was unresolved as either the sister taxon of *Nymphoides* or a lineage within the *Villarsia* grade. Phylogenetic analysis of morphological characters thus indicated that although *Nymphoides* is monophyletic, *Villarsia* does not comprise a morphologically coherent group (Tippery et al., 2008).

We have conducted an updated phylogenetic analysis of combined nucleotide (nuclear ribosomal ITS [nrITS], *rbcL*, *matK*, and *trnK* introns) and structural (encoded *matK/trnK* indels and nrITS secondary structure) molecular data, using the methods outlined in Tippery and Les (2008) and Tippery et al. (2008). In addition to previously reported sequences (Tippery et al., 2008), we obtained new molecular data for one *Villarsia* specimen from South Africa: *V. goldblattiana* Ornduff (*Rebelo 2008113001*, NBG), and two specimens from Western Australia: *V. submersa* (*Hort & Crawford 1845*, PERTH) and *V. violifolia* F. Mueller (*Ornduff 9342*, UC; GenBank accession numbers EU342366–EU342370, FJ546980–FJ546982). The resulting phylogeny (Fig. 1) produced a congruent topology but showed better-resolved interspecific relationships than the tree generated strictly from morphological data (Tippery et al., 2008). *Nymphoides* was strongly supported as monophyletic, whereas *Villarsia* resolved as three separate clades, one of which also contained *Liparophyllum* (Fig. 1). The two larger *Villarsia* clades consisted entirely of Australian taxa, and the other clade contained only the three South African species. Each of the Australian clades included taxa from both the eastern and western floristic regions of that continent (Takhtajan, 1986). The phylogeny depicted here (Fig. 1) represents a complete sampling of *Villarsia* species worldwide. It should be noted that separate analyses have resolved another species, *V. cambodiana* Hance from Southeast Asia, within *Nymphoides*, where we recommend its transfer (Tippery et al., 2010).

Although the clades of *Villarsia* that were resolved in the combined data analysis have never been suggested on the basis of morphology alone, several morphological characters nonetheless support them as separate, internally cohesive groups. Species in the clade that includes the anomalous, floating-leaved species *V. submersa* are united by their remarkably similar seeds that are ellipsoid with a subterminal hilum (Chuang & Ornduff, 1992). Seeds of most

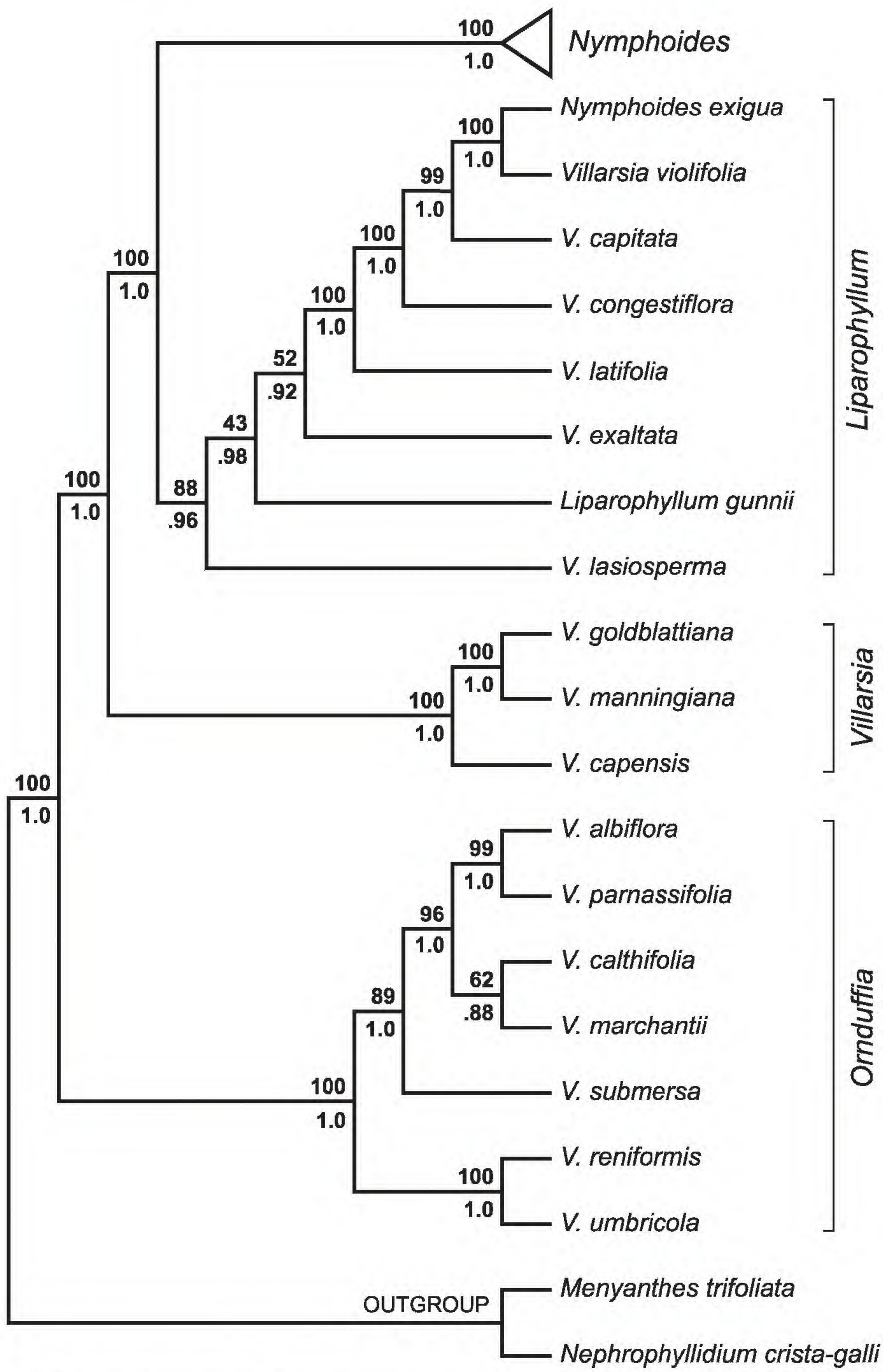

Figure 1. Phylogenetic relationships in Menyanthaceae, reconstructed using molecular data (nrITS, *matK*, *rbcL*, *trnK* introns, and nrITS secondary structure), with analyses as described by Tippery and Les (2008) and Tippery et al. (2008). Topology represents the single most-parsimonious tree; nodal values indicate parsimony bootstrap and Bayesian posterior probability support, above and below each branch, respectively. Names shown represent previously circumscribed *Villarsia* taxa. Revised generic circumscriptions proposed in this paper are depicted at right.

species in the clade are smooth, although some taxa (e.g., *V. albiflora* F. Mueller, *V. calthifolia* F. Mueller) have seeds that are densely covered with acuminate trichomes. In addition, species in the clade all have substantially more ovules per placenta than other *Villarsia* species (Tippery et al., 2008). The South African species, which form a second clade, are characterized by the most deeply fimbriate petal margins and the fewest seeds per capsule of any *Villarsia* (Ornduff, 2001; Tippery et al., 2008).

The third clade resolved by the combined data analysis is quite heterogeneous taxonomically and consists of species with varied growth habit, inflorescence architecture, and seed morphology (i.e., *Liparophyllum gunnii*, *Nymphoides exigua*, several *Villarsia* species). Nonetheless, subsets of the taxa within this clade share a number of distinctive traits that are found nowhere else in Menyanthaceae. Among the traits are inflorescences that are few flowered (*L. gunnii*, *N. exigua*, *V. violifolia*) or congested (*V. capitata* Nees ex Lehmann, *V. congestiflora* F. Mueller) and various distinguishing seed features that include sparse trichomes (*V. exaltata*, *V. lasiosperma* F. Mueller), a smooth testa with indistinct epidermal cells (*N. exigua*, *V. capitata*, *V. latifolia*, *V. violifolia*), or a nutritive caruncle (*V. congestiflora*, *V. exaltata*, *V. latifolia*, *V. violifolia*). None of these features occurs in the other *Villarsia* clades (Aston, 1969; Chuang & Ornduff, 1992; Tippery et al., 2008). Furthermore, all taxa in this otherwise diverse clade are distinct from other *Villarsia* in having between five and 10 ovules per placenta (Tippery et al., 2008).

Analyses of molecular data clearly indicate that *Villarsia* is paraphyletic as currently circumscribed (Fig. 1; Tippery et al., 2008). Consequently, in order to recognize groups that are meaningful phylogenetically, it will be necessary to revise the current taxonomy to reflect monophyletic genera. This objective can be achieved either by expanding *Nymphoides* to include all of *Villarsia* and *Liparophyllum*, or by subdividing *Villarsia* among the three clades that resolve in phylogenetic analyses (Fig. 1). Under the former scenario, the defining morphological features of *Nymphoides*, namely floating leaves that support a lax inflorescence, would no longer be diagnostic for the genus. In addition, the inclusion of morphologically diverse species under *Nymphoides* could precipitate a concomitant condensation of *Menyanthes* and *Nephrophyllidium* into a single genus so that Menyanthaceae genera would remain equivalently diverse. Alternatively, the latter scenario of subdividing *Villarsia* would preserve the distinctness of *Nymphoides* as well as provide unifying morphological traits for the separate *Villarsia* clades. Under neither scenario would the genus name *Villarsia* apply to any taxon in Australia, because the type species *V. capensis* belongs to the isolated South African clade (Fig. 1). In our opinion, optimal clarity would be achieved by retaining *Nymphoides* as currently circumscribed (except for *N. exigua*), while subdividing *Villarsia* among the clades that were identified by the molecular and morphological data analyses.

Here we revise the nomenclature for species that formerly belonged to *Villarsia*. The genus name remains associated with *V. capensis* and the other two South African species, *V. goldblattiana* and *V. manningiana* Ornduff. For the morphologically diverse group that includes *Liparophyllum gunnii*, *Nymphoides exigua*, and several *Villarsia* species, the genus *Liparophyllum* is expanded to include all species resolving within the clade. Lastly, we establish a new genus to accommodate the third group of *Villarsia* species, which is separated from other taxa in the phylogenetic analysis by a well-defined, strongly supported branch (Fig. 1; Tippery et al., 2008). The appropriate taxonomic combinations, including emended descriptions of the genera *Liparophyllum* and *Villarsia*, are provided below.

Taxonomic Treatment

I. Liparophyllum Hooker f., London J. Bot. 6: 472. 1847. TYPE: *Liparophyllum gunnii* Hooker f., London J. Bot. 6: 473. 1847.

Aquatic or wetland annual or perennial herbs. *Radical leaves* erect, with sheathing bases; sessile and linear (*Liparophyllum gunnii*) or petiolate with ovate or ellipsoid laminae, margins entire to crenate-dentate. *Inflorescence* paniculate; flowers 1 to 3 per node or congested into dense, sessile or subsessile capitula (*L. capitatum* (Nees ex Lehmann) Tippery & Les, *L. congestiflorum* (F. Mueller) Tippery & Les), or the whole inflorescence consisting of 1 to 5 flowers (*L. exiguum* (F. Mueller) Tippery & Les, *L. gunnii*, *L. violifolium* (F. Mueller) Tippery & Les). *Calyx* persistent, divided into 5 lobes; *corolla* yellow or white, gamopetalous, 5-lobed, rotate, throat fimbriate, margins entire or serrulate; *stamens* 5, alternate with corolla lobes, inserted on the corolla tube at the junction of the lobes; anthers 2-celled, sagittate, introrse; *ovary* unilocular with 2 parietal placentae; base surrounded by 5 glands (absent in *L. gunnii*); style solitary with 2 stigmas; *ovules* 5 to 10 per placenta. *Capsule* dehiscent into 4 valves, adnate to calyx at the base only (*L. gunnii*, *L. lasiospermum* (F. Mueller) Tippery & Les) or for more than 1/4 of length, of equal length or longer than the calyx; *seeds* 0.7–3 mm diam., orbicular or ellipsoid, smooth or sparsely covered with trichomes (< 1 trichome per

epidermal cell; *L. exaltatum* (Solander ex Sims) Tippery & Les, *L. lasiospermum*), hilum terminal (angle between major axis and hilum with vertex at seed center < 30°; angle approaches 30° in *L. exaltatum* and *L. latifolium*), caruncle present (*L. congestiflorum*, *L. exaltatum*, *L. latifolium*, *L. violifolium* (Bentham) Tippery & Les) or lacking.

1. **Liparophyllum capitatum** (Nees ex Lehmann) Tippery & Les, comb. nov. Basionym: *Villarsia capitata* Nees ex Lehmann, Pl. Preiss. 1: 365. 1845. *Limnanthemum capitatum* (Nees ex Lehmann) F. Mueller, Fragm. 9: 40. 1858. *Renealmia capitata* (Nees ex Lehmann) Kuntze, Revis. Gen. Pl. 430. 1891. TYPE: Australia. Western Australia: "In paludosis ad flumen Canning, Perth," Nov. 1841, *L. Preiss 1956* (holotype, LD; isotypes, B, G [2 sheets], GOET, L [3 sheets], M not seen, MEL [2 sheets], NSW, S, STR).

Villarsia involucrata Hooker, Icon. Pl. viii. 725. 1845. TYPE: Australia. Western Australia: Swan River, *J. Drummond 7* (holotype, K; isotype, MEL).

Typification. Duplicates of *Preiss 1956* are lodged in herbaria in Europe and Australia, although few of these bear more than cursory label information. Preiss specimens that were owned by Lehmann reside at LD (Stafleu & Cowan, 1983); indeed, the label of their *Preiss 1956* specimen bears locality information, apparently written by Preiss, matching the protologue: "In paludosis ad fl. Canning (Perth), Novbr. 41," with an additional note: "Flor. flavi." The species name appears above, clearly written by Nees. Although there are numerous duplicates of *Preiss 1956*, the provenance of the LD specimen and its annotation by both Preiss and Nees leave little doubt that it should be regarded as the holotype.

2. **Liparophyllum congestiflorum** (F. Mueller) Tippery & Les, comb. nov. Basionym: *Villarsia congestiflora* F. Mueller, Fragm. 6: 141. 1868. *Limnanthemum congestiflorum* (F. Mueller) F. Mueller, Syst. Census Austral. Pl. 90. 1882. *Renealmia congestiflora* (F. Mueller) Kuntze, Revis. Gen. Pl. 430. 1891. TYPE: Australia. Western Australia: Murchison River, s.d., *A. F. Oldfield s.n.* (lectotype, designated here, MEL).

Typification. In the original description of *Villarsia congestiflora*, Mueller (1868) designated two specimens, both collected by Oldfield: "Ad fluvios Swan-River et Murchison-River. Oldf." Three Oldfield specimens annotated by Mueller reside at MEL. Two of these (MEL 872 and 873) give only the locality "Near Perth" written by Oldfield, with another label on which Mueller wrote "Swan River." The third specimen (MEL 874), which we have selected as the lectotype, is the only one whose original label (written by Oldfield) matches the published text, and furthermore it represents the most morphologically complete specimen of the three.

3. **Liparophyllum exaltatum** (Solander ex Sims) Tippery & Les, comb. nov. Basionym: *Menyanthes exaltata* Solander ex Sims, Bot. Mag. 26: 1029. 1807. *Limnanthemum exaltatum* (Solander ex Sims) F. Mueller, Fragm. 9: 165. 1875. *Renealmia exaltata* (Solander ex Sims) Kuntze, Revis. Gen. Pl. 430. 1891. TYPE: Australia. New South Wales: 28 Apr.–5 May 1770, *J. Banks & D. C. Solander s.n.* (lectotype, designated by Aston, 1969: 44, BM; isotype, NSW not seen).

4. **Liparophyllum exiguum** (F. Mueller) Tippery & Les, comb. nov. Basionym: *Limnanthemum exiguum* F. Mueller, Fragm. 1: 40. 1858. *Villarsia exigua* (F. Mueller) Hooker f., Bot. Antarct. Voy., Vol. 3, Fl. Tasman. 2: 368. 1859. *Nymphoides exigua* (F. Mueller) Kuntze, Revis. Gen. Pl. 430. 1891. TYPE: Australia. Tasmania: "Wet muddy places in brackish water, South Port," s.d., *A. F. Oldfield s.n.* (holotype, K).

5. **Liparophyllum lasiospermum** (F. Mueller) Tippery & Les, comb. nov. Basionym: *Villarsia lasiosperma* F. Mueller, Fragm. 6: 137. 1868. *Limnanthemum lasiospermum* (F. Mueller) F. Mueller, Fragm. 9: 165. 1875. *Renealmia lasiosperma* (F. Mueller) Kuntze, Revis. Gen. Pl. 430. 1891. TYPE: Australia. Western Australia: Swamps at King George Sound, Albany, Oct. 1867, *F. Mueller s.n.* (lectotype, designated here, MEL).

Typification. Mueller (1868) listed several of his own collections in the description of *Villarsia lasiosperma*: "In paludibus aqua pura repletis prope urbem Albany, ad bases montium Willyung et montes Porongorup versus. F.M." Three specimens at MEL were interpreted by Aston (1969) to represent syntypes, although curiously none of their labels matches the published text exactly: "Forest swamps north of Albany, Oct. 1867," with an apparently later label "Swamps at King George's Sound, Oct. 67" (MEL 875); "Swamps in the rear of Mt. Melville, Oct. 67," two packets apparently containing seeds, with a later label "Swamps at King George's Sound (fresh water), Oct. 67" (MEL 16493); "Heath swamps north of Albany, Oct. 1867," with the same text reproduced on a later label (MEL 16494). We have selected the first of these (MEL 875) to be the lectotype, because it is the most morphologically complete specimen and

its locality description most closely matches the text of the original publication.

6. **Liparophyllum latifolium** (Bentham) Tippery & Les, comb. nov. Basionym: *Villarsia latifolia* Bentham, Enum. Pl. (Endlicher) 81. 1837. *Limnanthemum latifolium* (Bentham) F. Mueller, Fragm. 9: 164. 1875. *Renealmia latifolia* (Bentham) Kuntze, Revis. Gen. Pl. 430. 1891. TYPE: Australia. Western Australia: "King George's Sound," s.d., *C. Hügel s.n.* (holotype, W).

7. **Liparophyllum violifolium** (F. Mueller) Tippery & Les, comb. nov. Basionym: *Villarsia violifolia* F. Mueller, Fragm. 6: 138. 1868. *Limnanthemum violifolium* (F. Mueller) F. Mueller, Syst. Census Austral. Pl. 90. 1882. *Renealmia violifolia* (F. Mueller) Kuntze, Revis. Gen. Pl. 430. 1891. TYPE: Australia. Western Australia: Don River, s.d., *T. C. Maxwell s.n.* (lectotype, designated here, MEL).

Typification. Mueller (1868) listed several localities and collectors in the original description of *Villarsia violifolia*: "Ad fluvios Tweed et Don's River; Oldf. Maxw. Prope urbem Hamden, Clarke." Three specimens at MEL, clarified by Aston (1969), conform to the description: "S. W. Austr." collected by Clarke (label in Mueller's hand; MEL 16489); "Plts. matted, fl. yellow, Tweed R. W. Aust." collected by Oldfield (MEL 16490); "Don River, S. W. Aust." collected by Maxwell (labels written by Mueller; MEL 16491 and 16492). Of these, the most complete specimen is the collection by Maxwell, specifically MEL 16491, which we designate as the lectotype.

II. **Ornduffia** Tippery & Les, gen. nov. TYPE: *Villarsia reniformis* R. Brown, Prodr. Fl. Nov. Holland. 437. 1810 ≡ *Ornduffia reniformis* (R. Brown) Tippery & Les.

Genus foliis simplicibus, inflorescentia diffusa paniculataque, lobo corollino quoque alam medianam carenti, capsula fundo solum ad calycem adnata, seminibus non carunculatis *Villarsiae* Ventenat simile, sed ab eo marginibus loborum corollinorum integris serrulatisve, ovulis ad quamque placentam plus quam 10, seminibus ellipticis hilo subterminali differt.

Aquatic or wetland perennial herbs. *Radical leaves* erect or floating, petiolate, with sheathing bases; laminae simple, ovate or ellipsoid, margins entire to crenate-dentate. *Inflorescence* paniculate; flowers 1 to 3 per node. *Calyx* persistent, divided into 5 lobes; *corolla* yellow or white, gamopetalous, 5-lobed, rotate, throat fimbriate, margins entire or serrulate; *stamens* 5, alternate with corolla lobes, inserted on the corolla tube at the junction of the lobes; anthers 2-celled, sagittate, introrse; *ovary* unilocular with 2 parietal placentae; base surrounded by 5 glands; style solitary with 2 stigmas; *ovules* 11 or more per placenta. *Capsule* dehiscent into 4 valves, adnate to calyx only at the base; *seeds* 0.5–1.9 mm diam., ellipsoid, smooth or densely covered with trichomes (one per epidermal cell; *O. albiflora* (F. Mueller) Tippery & Les, *O. calthifolia* (F. Mueller) Tippery & Les, *O. marchantii* (Ornduff) Tippery & Les, *O. umbricola* var. *beaugleholei* (Aston) Tippery & Les), hilum subterminal (angle between major axis and hilum with vertex at seed center > 30°), without a conspicuous caruncle.

Etymology. We have chosen the generic name *Ornduffia* to honor the late Robert Ornduff (1932–2000), who contributed immensely to the study of reproductive system ecology and evolution in Menyanthaceae, and *Villarsia* in particular.

1. **Ornduffia albiflora** (F. Mueller) Tippery & Les, comb. nov. Basionym: *Villarsia albiflora* F. Mueller, Fragm. 2: 21. 1860. *Limnanthemum albiflorum* (F. Mueller) F. Mueller, Syst. Census Austral. Pl. 90. 1882. *Renealmia albiflora* (F. Mueller) Kuntze, Revis. Gen. Pl. 430. 1891. TYPE: Australia. Western Australia: Perth, s.d., *A. F. Oldfield s.n.* (lectotype, designated here, MEL).

Typification. Mueller (1860) indicated two collections in the description of *Villarsia albiflora*: "In stagnis propre oppida Perth et Hampden. Clarke et Oldfield." Aston (1969) located two corresponding Oldfield specimens at MEL: "Fl. white, Hampden, W. A." (MEL 16430) and "Perth, W. Aust." (MEL 16447). We designate the latter specimen (MEL 16447), which has more leaves and flowers, as the lectotype.

2. **Ornduffia calthifolia** (F. Mueller) Tippery & Les, comb. nov. Basionym: *Villarsia calthifolia* F. Mueller, Fragm. 6: 140. 1868. *Limnanthemum calthifolium* (F. Mueller) F. Mueller, Fragm. 9: 164. 1875. *Renealmia calthifolia* (F. Mueller) Kuntze, Revis. Gen. Pl. 430. 1891. TYPE: Australia. Western Australia: Porongorup, Oct. 1867, *F. Mueller s.n.* (lectotype, designated here, MEL).

Typification. The original description of *Villarsia calthifolia* (Mueller, 1868) listed the locality "In rivulis et in summitatibus rupestribus montium Porongorup. F. M." Aston (1969) identified three Mueller specimens that she considered syntypes: "Porongorup" (MEL 16480); "Summit of the Porongorup. Cor. yellow. Oct. 67" (MEL 16481); and "Porongorup" (NSW 90574). None of the specimens

represents an entire plant, but the most complete combination of leaf and inflorescence occurs on one of the Melbourne sheets (MEL 16481), which we designate as the lectotype.

3. **Ornduffia marchantii** (Ornduff) Tippery & Les, comb. nov. Basionym: *Villarsia marchantii* Ornduff, Syst. Bot. 15: 216–220. 1990. TYPE: Australia. Western Australia: Wet soil in deep shade of *Trymalium* thicket, below Wansbrough Walk on N side of Porongorup Range, elevation 450 m, 15 Nov. 1983, *R. Ornduff 9323* (holotype, PERTH).

4. **Ornduffia parnassifolia** (Labillardière) Tippery & Les, comb. nov. Basionym: *Swertia parnassifolia* Labillardière, Nov. Holl. Pl. 1: 72, t. 97. 1805. *Villarsia parnassifolia* (Labillardière) R. Brown, Prodr. Fl. Nov. Holland. 457. 1810, as "*V. parnassiifolia.*" *Limnanthemum parnassifolium* (Labillardière) F. Mueller, Fragm. 9: 165. 1875. *Renealmia parnassifolia* (Labillardière) Kuntze, Revis. Gen. Pl. 430. 1891. TYPE: Australia. Western Australia: In terra Van-Leeuwin, s.d., *J. J. H. Labillardière s.n.* (lectotype, designated by Aston, 1969: 37, FI; isotypes, BM, MEL, NSW).

5. **Ornduffia reniformis** (R. Brown) Tippery & Les, comb. nov. Basionym: *Villarsia reniformis* R. Brown, Prodr. Fl. Nov. Holland. 457. 1810. TYPE: Australia. Tasmania: Port Dalrymple, s.d., *W. Paterson s.n.* (lectotype, designated by Aston, 1969: 50, BM).

6. **Ornduffia submersa** (Aston) Tippery & Les, comb. nov. Basionym: *Villarsia submersa* Aston, Muelleria 2: 19. 1969. TYPE: Australia. Western Australia: Boyanup, 9 Sep. 1953, *R. D. Royce 3778* (holotype, PERTH; isotype, MEL).

7. **Ornduffia umbricola** (Aston) Tippery & Les, comb. nov. Basionym: *Villarsia umbricola* Aston, Muelleria 2: 53. 1969. TYPE: Australia. South Australia: ca. 4 mi. direct line ESE of Myponga, betw. Myponga & Hindmarsh Valley, 18 Dec. 1966, *H. I. Aston 1531* (holotype, MEL; isotypes, AD not seen, K not seen, NSW).

8. **Ornduffia umbricola** var. **beaugleholei** (Aston) Tippery & Les, comb. nov. Basionym: *Villarsia umbricola* var. *beaugleholei* Aston, Muelleria 2: 55. 1969. TYPE: Australia. Victoria: 1.3 mi. W of Dergholm, along the rd. to Penola, 15 Dec. 1965, *H. I. Aston 1445* (holotype, MEL; isotypes, AD not seen, BM not seen, K not seen, MEL not seen, NSW, PERTH).

III. **Villarsia** Ventenat, Choix Pl. t. 9. 1803, nom. cons. TYPE: *Villarsia ovata* (L. f.) Ventenat, Choix Pl. t. 9. 1803, typ. cons., ≡ *Menyanthes ovata* L. f., Suppl. Pl. 133. 1781, = *V. capensis* (Houttuyn) Merrill, J. Arnold Arbor. 19: 360. 1938. *Renealmia capensis* Houttuyn, Handl. Pl.-Kruidk. 8: 335. 1777.

Aquatic or wetland perennial herbs. *Radical leaves* erect, with sheathing bases; petiolate with ovate or ellipsoid laminae, margins entire to crenate-dentate. *Inflorescence* paniculate; flowers 1 to 3 per node. *Calyx* persistent, divided into 5 lobes; *corolla* yellow, gamopetalous, 5-lobed, rotate, throat fimbriate, margins deeply fimbriate; *stamens* 5, alternate with corolla lobes, inserted on the corolla tube at the junction of the lobes; anthers 2-celled, sagittate, introrse; *ovary* unilocular with 2 parietal placentae; base surrounded by 5 glands; style solitary with 2 stigmas; *ovules* 1 to 4 per placenta. *Capsule* dehiscent into 4 valves, adnate to calyx only at the base; of equal length or shorter than the calyx; *seeds* 1.5–2.5 mm diam., orbicular, smooth or with bulliform protuberances, hilum terminal (angle between major axis and hilum with vertex at seed center > 30°), without a conspicuous caruncle.

Key to Genera of Menyanthaceae Worldwide

1a. Leaves trifoliate; inflorescence an erect raceme with > 10 flowers. . . . . *Menyanthes*
1b. Leaves simple; inflorescence lax, or if erect, then capitate, paniculate, or consisting of < 5 flowers. . . . 2
2a. Leaves erect, their margins distinctly crenate; pollen grains subprolate to prolate; seeds with distinct, narrowly elongate epidermal cells, their surface smooth . . . . . *Nephrophyllidium*
2b. Leaves floating, or if erect then margins entire, dentate, or indistinctly crenate; pollen grains peroblate to suboblate; seeds with indistinct or orbicular epidermal cells, their surface smooth, roughened, tuberculate, or possessing trichomes . . . 3
3a. Plants submersed with floating leaves (emergent in mudflat forms or when crowded); inflorescence lax, the flowers in pairs or umbellate, supported by 1 or more floating leaves, or erect and paniculate with > 10 flowers occurring in pairs . . . . . *Nymphoides*
3b. Plants submersed (*O. submersa*) or emergent, with erect and/or floating leaves; inflorescence erect or lax; if erect, then either capitate, paniculate with flowers arising singly (rarely paired), or consisting of ≤ 5 flowers; if lax, then never supported by a floating leaf (*O. submersa*) 4
4a. Corolla lobe margins fimbriate; each placenta with 1 to 4 ovules; seeds orbicular, > 1.5 mm diam. . . . *Villarsia*
4b. Corolla lobe margins entire or serrulate; each placenta with ≥ 5 ovules; seeds ellipsoid, or < 1.4 mm diam. if orbicular 5
5a. Each placenta with 5 to 10 ovules; inflorescence capitate, paniculate, or reduced to ≤ 5 flowers; seeds lacking trichomes on some or all epidermal cells; if trichomes absent, then either margins of

epidermal cells inconspicuous (under 100× magnification) or seed caruncle present. . . *Liparophyllum*

5b. Each placenta with ≥ 11 ovules; inflorescence always paniculate with > 10 flowers; seeds bearing a trichome on each epidermal cell or, if trichomes absent, then margins of epidermal cells conspicuous; seed caruncle absent . . . . . *Ornduffia*

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Paepalanthus bonsai, a New Species of Eriocaulaceae from Minas Gerais, Brazil

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Abstract. We describe and illustrate the new species *Paepalanthus bonsai* Trovó & Sano (Eriocaulaceae, Paepalanthoideae) from the Espinhaço Range in Minas Gerais, Brazil. This species is placed in *Paepalanthus* Martius subsect. *Dichocladus* Ruhland due to its dichotomously branched stem with rigid linear leaves. The new species is compared with the sympatric and morphologically similar species *P. glaziovii* Ruhland.

Resumo. Descrevemos e ilustramos a nova espécie *Paepalanthus bonsai* Trovó & Sano (Eriocaulaceae, Paepalanthoideae) ocorrente na Cadeia do Espinhaço, em Minas Gerais, Brasil. A espécie é posicionada em *Paepalanthus* Martius subsect. *Dichocladus* Ruhland por possuir caule dicotomicamente ramificado e folhas lineares rígidas. Comparamos esta nova espécie com a espécie simpátrica e mais semelhante morfologicamente, *P. glaziovii* Ruhland.

Key words: Brazil, Eriocaulaceae, Espinhaço Range, IUCN Red List, Minas Gerais, *Paepalanthus*.

Paepalanthus Martius is the largest Neotropical genus of Eriocaulaceae, with approximately 450 species; its taxonomic and species diversity is concentrated in the Espinhaço Range, Brazil, and the tepuis of Venezuela. The Brazilian center is the more diverse of the two areas, and indeed a further distinction can be seen with a greater number of species in the Minas Gerais portion of the Espinhaço Range. *Paepalanthus* occurs predominantly on rocky outcrops and less frequently in open savannas (Giulietti & Hensold, 1990; Hensold, 1991, 1999; Stützel, 1998).

Ruhland (1903) divided the genus into 28 categories based on floral and especially vegetative features. One distinctive group is *Paepalanthus* subsect. *Dichocladus* Ruhland, which is distinguished by the elongate and dichotomously branched stems and by the rigid leaves no more than 2 cm long. Körnicke (1863) previously recognized the affinity of *P. dichotomus* Klotzsch ex Koernicke, *P. guyanensis* Klotzsch ex Koernicke, and *P. muscosus* Koernicke from northern South America based on the habit of these species. Later, Ruhland (1903) described *P. glaziovii* Ruhland from Minas Gerais and placed all four taxa in *Paepalanthus* subsect. *Dichocladus*. Finally, Hensold (1991) synonymized *P. guyanensis* into *P. dichotomus*. In addition, Harold Moldenke described several species of *Paepalanthus* without assigning them to infra-generic levels. Some of these species (e.g., *P. aristatus* Moldenke) have similar habit and floral morphology to species of *Paepalanthus* subsect. *Dichocladus* and may be merged within this category (Hensold, 1991, 1999).

Paepalanthus bonsai Trovó & Sano, sp. nov. TYPE: Brazil. Minas Gerais: São Gonçalo do Rio Preto, Parque Est. do Rio Preto, 18°12′57″S, 43°20′81″W, 24 May 2007, *P. L. Viana, N. F. O. Furtado, M. G. L. Wanderley, R. Louzada 2776* (holotype, SPF; isotypes, B, BHCB, K, MO). Figures 1, 2.

Haec species a *Paepalantho glaziovii* Ruhland habitu humiliore (usque ad 9 cm vs. 20 cm), caule breviore (usque ad 7.5 cm vs. 18 cm), crassiusculo vaginis foliaribus inducto et laminis foliaribus non nisi in apice caulis persistentibus differt.

Perennial herbs forming small dense cushions, 6.5–9 cm tall, stem elongate, 5–7.5 cm, branched, covered by leaf sheaths. Leaves rigid, falciform, 0.4–1.2 × 0.1–0.2 mm, adaxial surface glabrous, abaxial surface glabrescent, apex acute, margins ciliate, densely ciliate at base, restricted only to stem apex. Spathes 2–5 mm, glabrescent, apex truncate, long ciliate; scapes 1 to 6 per branch, 5–15 mm, glabrescent with simple trichomes; capitula 2–4 mm diam., urceolate; involucral bracts brown, arranged in 3 to 4 series, bracts of the inner series triangular, ca. 3 mm, with trichomes on the abaxial surface, apex obtuse, ciliate in the upper margin, those from the outer series oblong, ca. 2 mm, glabrous, apex acute, glabrous margins; receptacle hemispheric, pubescent. Flowers 3-merous, ca. 35 per capitula: 33 staminate, 2

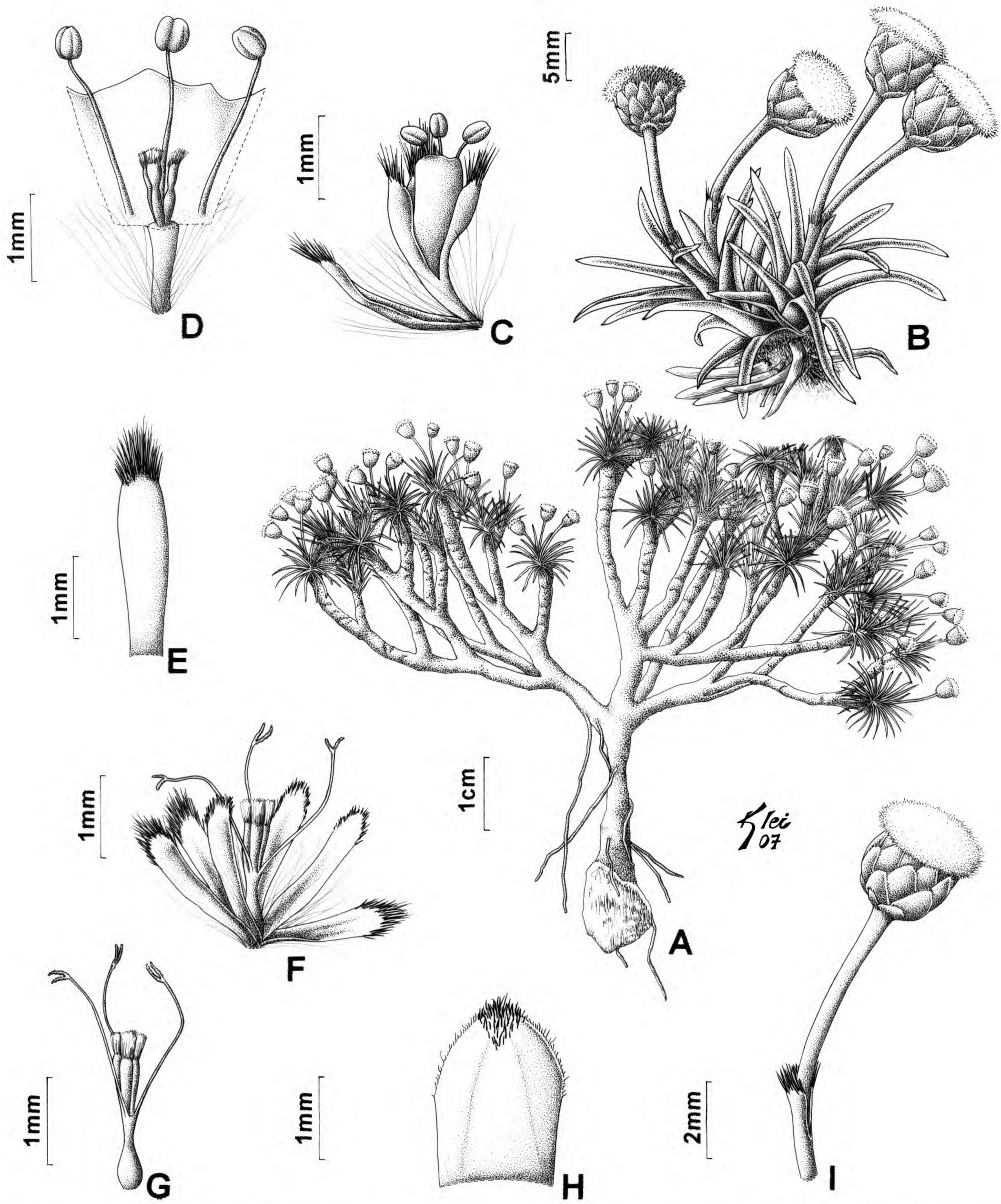

Figure 1. *Paepalanthus bonsai* Trovó & Sano. —A. Habit. —B. Floral branch detail. —C. Staminate flower with floral bract. —D. Staminate flower detail with sepals removed. —E. Floral bract abaxial surface. —F. Pistillate flower. —G. Gynoecium detail. —H. Involucral bract, abaxial surface. —I. Spathe, scape, and capitulum detail. Drawn from the holotype *Viana et al. 2776* (SPF).

pistillate; floral bracts narrowly oblong, ca. 3 mm, glabrous, apex acute, ciliate in the upper margin. Staminate flowers ca. 3 mm; pedicel ca. 1 mm, with trichomes; sepals oblong, ca. 3 mm, glabrous, apex obtuse, ciliate in the upper margin; corolla tubular, ca. 1.5 mm, membranaceous, hyaline, glabrous, 3-lobed; stamens ca. 2 mm; pistillodes 3, papillose. Pistillate flowers ca. 3 mm, sessile; sepals oblong, ca. 3 mm, glabrous, apex obtuse, ciliate in the upper margin; petals obovate, ca. 3 mm, glabrous, apex acute, ciliate in the upper margin; gynoecium ca. 3 mm, stigmatic portions bifid, twice the length of the

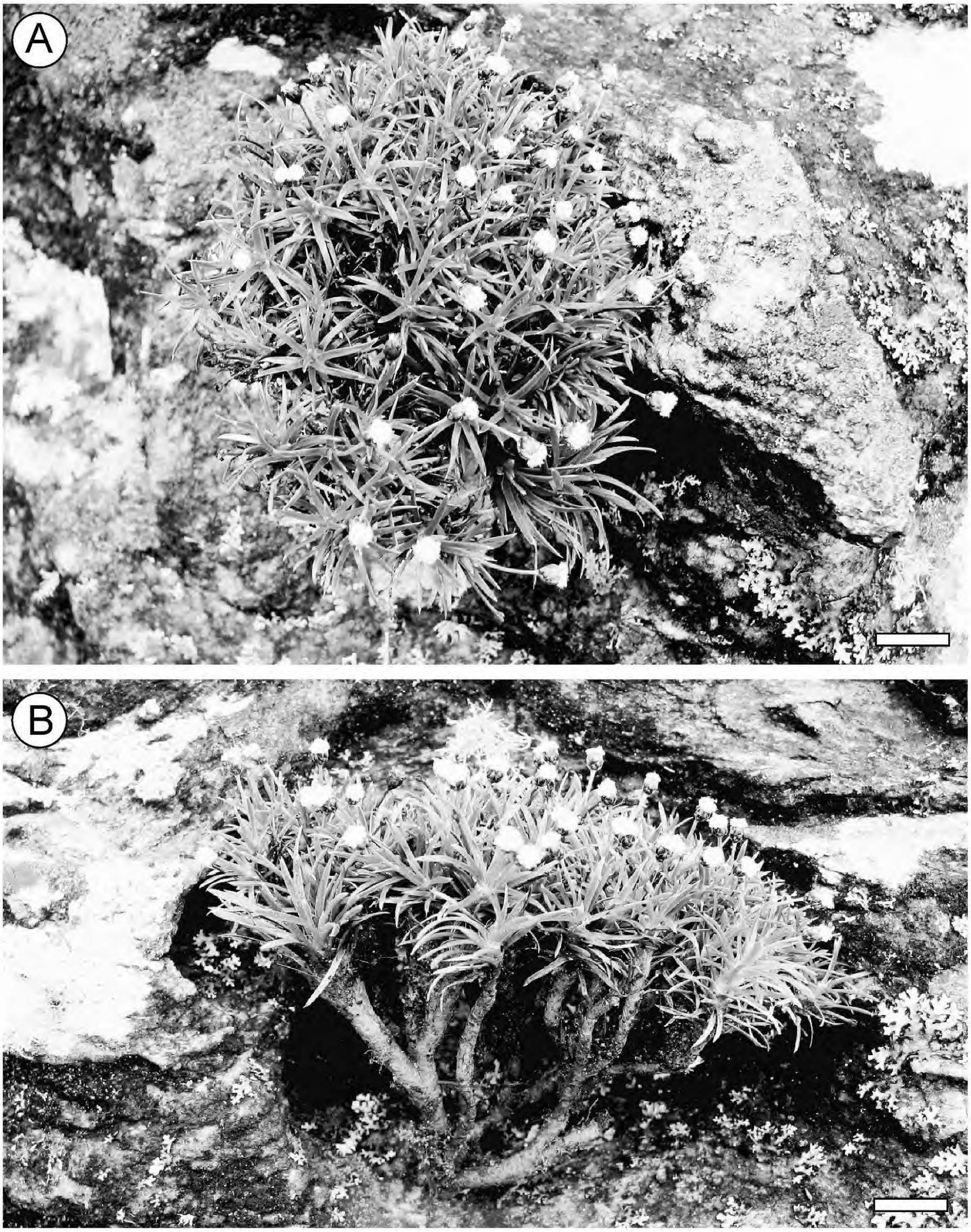

Figure 2. *Paepalanthus bonsai* Trovó & Sano, plant habit. —A. As seen from above. —B. Lateral view. Scale bars: 1 cm. Photos of the holotype *Viana et al. 2776* (SPF) in the field. (Photos by Rafael Louzada, SP.)

nectariferous portion; staminodes 3, scale-like. Fruit a loculicidal capsule.

Habitat and distribution. The species occurs in the Rio Preto State Park, in the Espinhaço Range in Minas Gerais State. The species was collected at an altitude of approximately 1400 m, in an area of a rocky outcrop dominated by montane meadows (an open, grass-dominated area).

IUCN Red List category. *Paepalanthus bonsai* is known from a single locality within a conservation unit.

According to IUCN Red List criteria (IUCN, 2001), the species is considered Critically Endangered (CR B1a).

Etymology. The epithet *bonsai* refers to the general habit of the species. Although it forms small dense cushions in rocky crevices, the branched habit and deciduous leaves give the appearance of a miniaturized tree. The epithet is used as a noun in apposition, as supported by Art. 23.1 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006).

Discussion. We place *Paepalanthus bonsai* in *Paepalanthus* subsect. *Dichocladus* based on its trimerous flowers, elongated dichotomously branched stem, and small rigid leaves. This group consists now formally of four species, excluding the species described by Harold Moldenke. *Paepalanthus bonsai* and *P. glaziovii* occur in Minas Gerais State, and *P. muscosus* and *P. dichotomus* occur in northern South America. Two types of floral morphology can be detected in *Paepalanthus* subsect. *Dichocladus*. The stigmatic portions are not completely fused in *P. bonsai* and *P. glaziovii* (although in the original description the author described simple stigmas for *P. glaziovii*), whereas they are completely fused in *P. muscosus* and *P. dichotomus*. Given that the well-defined groups in Eriocaulaceae are generally homogeneous in this floral structure and Ruhland (1903) stated that the inclusion of *P. glaziovii* in *Paepalanthus* subsect. *Dichocladus* was doubtful, further phylogenetic studies are required to clarify the relations among these species.

Of the species in subsection *Dichocladus*, *Paepalanthus bonsai* is morphologically most similar to *P. glaziovii*, which also occurs in the Espinhaço Range in Minas Gerais. Both have been collected in the same locality at a mountain locally known as Chapada do Couto; therefore, they are considered sympatric. These two species share a very similar branching pattern, urceolate capitula, and stigmatic portions that are not completely fused. However, *P. glaziovii* has persistent leaves among the ramifications, while *P. bonsai* has leaves only at the apex of the distal branches and the stem is covered by leaf sheaths. *Paepalanthus bonsai* is also distinguished by its smaller habit (ca. 10 cm tall vs. ca. 20 cm tall in *P. glaziovii*) and relatively thick stem with short internodes (vs. a relatively thin stem with elongated internodes in *P. glaziovii*).

Paratypes. BRAZIL. **Minas Gerais:** São Gonçalo do Rio Preto, Parque Est. do Rio Preto, 2000, *L. Bedê s.n.* (BHCB), 2003, *P. L. Viana, M. Sobral, R. C. Mota, F. S. F. Leite, A. P. Lorenz 1222* (BHCB).

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A New Zygomorphic-Flowered *Rinorea* (Violaceae) from the Neotropics

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Abstract. A distinctive new species from the Neotropics, *Rinorea zygomorpha* H. E. Ballard & Wahlert (Violaceae), is described and illustrated. It has several character states unique to Neotropical *Rinorea* Aublet, including a strongly zygomorphic corolla and single-seeded capsule, which distinguish it from other New World species. The new species is also aberrant in several respects in the family, with bifid dorsal connective appendages, stipitate ovary and fruit, and lateral attachment on the laterally compressed seed. A key is presented to separate this new species from other Neotropical members of *Rinorea*. An assessment of IUCN status using ArcView GIS software with georeferenced localities places the new species in the Least Concern category.

Key words: IUCN Red List, Neotropics, *Rinorea*, Violaceae.

Rinorea Aublet (Violaceae) is a pantropical genus of woody shrubs and small trees with an estimated 155 to 210 species (Ballard, unpublished data). The 48 species of Neotropical *Rinorea* are generally well known, owing to a monograph of the genus by Hekking (1988). *Rinorea* can be a common understory element in lowland tropical rainforests and semi-deciduous forests, yet the diversity and distribution of species are not well understood, particularly for African and Southeast Asian species. No infrageneric classification has been proposed for the entire genus, and phylogenetic relationships among the world's *Rinorea* species are not yet known.

Until now, Neotropical *Rinorea* have been described generally as having actinomorphic corollas (e.g., in floras and diagnostic keys). However, a carefully dissected flower often reveals the tendency toward zygomorphy in the calyx and the corolla. In most cases, three sets of sepals and petals can be identified: one anterior and two pairs each of lateral and posterior sepals and petals. Some species also show zygomorphic symmetry in the ornamentation and insertion of the staminal tube and in the orientation of the style (Hekking, 1988; Wahlert & Ballard, pers. obs.). In Hekking's (1988) careful revision of Neotropical *Rinorea*, it is curious that he did not address the trend toward zygomorphic flowers in some species. Study of floral dissections of Neotropical *Rinorea* shows some species to have a subequal calyx and corolla, while others tend toward weakly zygomorphic flowers (Wahlert & Ballard, unpublished data). The strongly zygomorphic corolla of the new species described here makes it instantly recognizable and distinct from all other Neotropical *Rinorea*.

Examination of herbarium material at the Ecuadorian Museum of Natural Sciences (QCNE) revealed specimens with strikingly zygomorphic corollas and zygomorphic, one-seeded capsules that had been misidentified as *Rinorea apiculata* Hekking or *R. guianensis* Aublet. The aberrant specimens superficially resembled *R. guianensis* in their phyllotaxy, gross leaf morphology, and thyrsoid inflorescences, but were immediately distinct from it upon scrutiny of the flowers and fruits. Subsequent examination of other collections uncovered many additional misidentified specimens of a fairly widely distributed Neotropical species with strongly zygomorphic corollas and unusual fruits. The new species is now represented by collections at two separate sites in east-central Panama and many specimens from approximately 20 more sites in eastern Ecuador and adjacent Peru (Fig. 1).

Intensive study of accumulated material from AAU, MO, U, and WIS has revealed a suite of characters not seen in other Neotropical *Rinorea* species or, in some cases, other genera of the Violaceae. Features not documented previously in Neotropical *Rinorea* include the strongly zygomorphic corolla, single seed per capsule, and zygomorphic capsule symmetry (but with straight sutures). Other traits that are novel in the family are the bifid apices of the dorsal connective scales, the maturing ovary enlarging apically as a "cap" that differs in color and texture from the ovary base, the strongly indented dehiscence sutures on the ovary "cap" and mature fruit, the stipitate base of the ovary persisting into fruit, and the lateral attachment of the laterally compressed asymmetrical seed. This assemblage of novel character states (Fig. 2) initially led us to conclude that the misidentified taxon was probably a new genus. However, evidence from DNA sequences of the *trnL* intron and *trnL-F* spacer strongly support placement of the new species within *Rinorea* and more specifically with Neotropical taxa (see below).

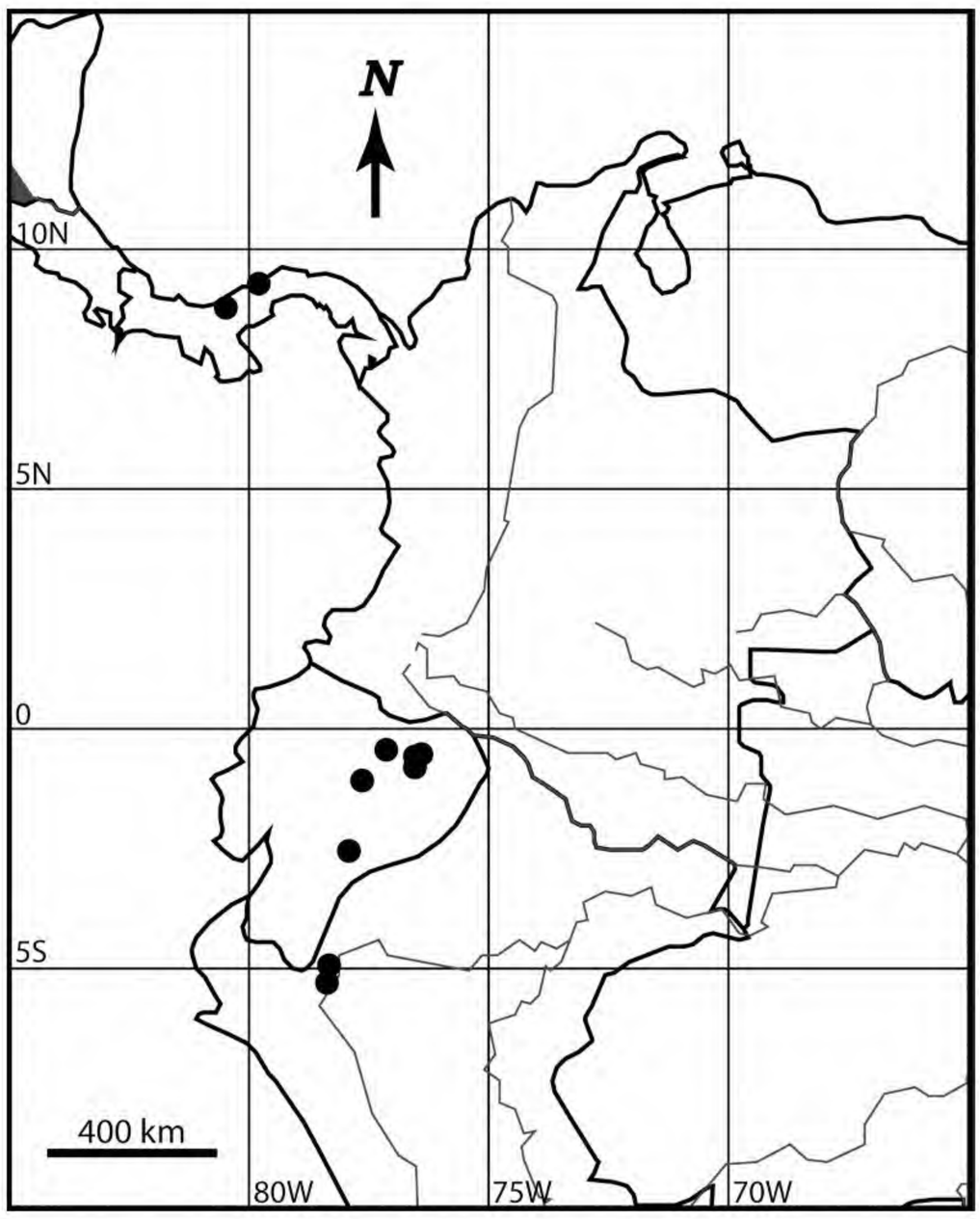

Figure 1. Geographic distribution of *Rinorea zygomorpha* H. E. Ballard & Wahlert in Latin America.

The diagnostic key presented below, adapted from Hekking (1988), separates the distinctive new *Rinorea* from its Neotropical congeners. Group names are informal names proposed by Hekking (1988).

KEY TO INFORMAL TAXONOMIC GROUPS OF NEOTROPICAL *RINOREA*

1a. Leaves opposite . . . . . Pubiflora group
1b. Leaves alternate 2
2a. Dorsal connective scales strictly apical . . . . . Apiculata group
2b. Dorsal connective scales apical and lateral. 3
3a. Corollas subequal to weakly zygomorphic; connective scale apices not bifid; developing ovary not differentiated into an apical "cap" on a differently colored and textured base; neither ovary nor capsule stipitate; capsules 3- to 12-seeded. . . . . .Rinorea group
3b. Corollas strongly zygomorphic; connective scale apices bifid; developing ovary with apical "cap" different in color and texture from ovary base; ovary base persisting as a stipe in fruit; capsules 1-seeded . . . *Rinorea zygomorpha* H. E. Ballard & Wahlert

Rinorea zygomorpha H. E. Ballard & Wahlert, sp. nov. TYPE: Ecuador. Prov. Napo: Añangu, in the Parque Nacional Yasuní, 0°31′30″S, 76°23′W, 260–350 m, Dec. 1983, *J. Korning & K. Thomsen 8610* (holotype, AAU; isotypes, MO, NY). Figure 2.

Haec species quoad folia alterna, nervationem tertiariam scalariformem et inflorescentiam thyrsiformem ad *Rinoream guianensem* Aublet accedit, sed ab ea corolla zygomorpha, petalo postico dense lanato, filamentorum summo tubi irregulariter lacerato, antherarum connectivorum dorsalium apicibus bidentatis, ovario maturescenti e pileo apicali indurescente suturis indentatis manifestis notato, fundo ovarii in fructu pro stipite persistenti atque in capsula semine solitario lateraliter compresso et affixo differt.

Tree 3–20 m tall, stem to 20 cm diam.; terminal branchlets terete, glabrous or hispidulous. Leaves alternate, petiolate; petiole 5–13 mm, glabrescent or strigillose; stipules persistent, free, lanceolate, 5–10 × 0.9–2 mm, herbaceous, outer surface glabrous or sparsely strigillose, veins present, margin entire, ciliolate, apex acuminate; leaves elliptic, lanceolate-obovate, or broadly lanceolate, blade 13–20 × 4.5–8.5 cm, herbaceous (occasionally papery or subcoriaceous), adaxially glabrous, abaxially glabrous or strigillose, midrib glabrous or strigillose, leaf domatia absent, secondary veins 9 to 11, ascending, tertiary veins scalariform, base rounded or subtruncate to broadly cuneate, symmetrical, margin crenate or subserrate to subentire, glabrous, apex acuminate or cuspidate. Inflorescences axillary, lateral, terminal or subterminal, pseudoracemose or basally branched thyrse, 5.5–13 cm long, 3–15 cm diam., lateral cymules with 3 to 5 normal flowers and often few to several additional aborted flower buds, axis puberulent; pedicel 1.5–2.7 mm, articulated near the middle, hispidulous; peduncle bracts eventually deciduous, broadly triangular, ca. 2.2 × 1.4 mm, herbaceous, 1-veined, outer surface hispidulous, margin entire, ciliolate, apex abruptly mucronulate; pedicel bractlets deciduous. Flowers 3.7–4.7 mm, bisexual; sepals subequal in size and shape, suborbicular or narrowly ovate, 1.9–2 × 1–1.5 mm, (1)3- to 5-veined, outer surface sparsely hispidulous, margin entire, ciliolate or ciliate, apex obtuse or rounded; petals white or cream, petal aestivation apotact, corollas zygomorphic; posterior ("upper") pair of petals broadly oblong or narrowly elliptic, 3.2–3.7 × 0.8–0.9 mm, outer surface pilosulous or puberulent, inner surface glabrous, margin ciliate near the base, apex rounded; lateral petals weakly bottle-shaped and often somewhat falcate, 3.2–3.8 × 1.2–1.3 mm, outer surface pilosulous or pubescent, inner surface sparsely pilosulous apically, margin ciliate, apex rounded; anterior ("bottom") petal strongly bottle-shaped, 3.6–3.8 × 1.1–1.3 mm, outer surface strigillose along costa, inner surface pilose throughout, margin ciliate, apex deeply emarginate, the lobes often incurled; stamens 5, 3–3.5 mm, all filaments almost fully connate into a continuous tube, tube ca. 0.3 mm tall below anthers, glabrous, irregularly lacerate at summit; anthers borne on very short free portion of filament, free portion attached to inner upper surface of filament tube, ca. 0.1 × 0.1–0.2 mm; anther connectives ovate, 0.7–0.8 × ca. 0.7 mm, outer

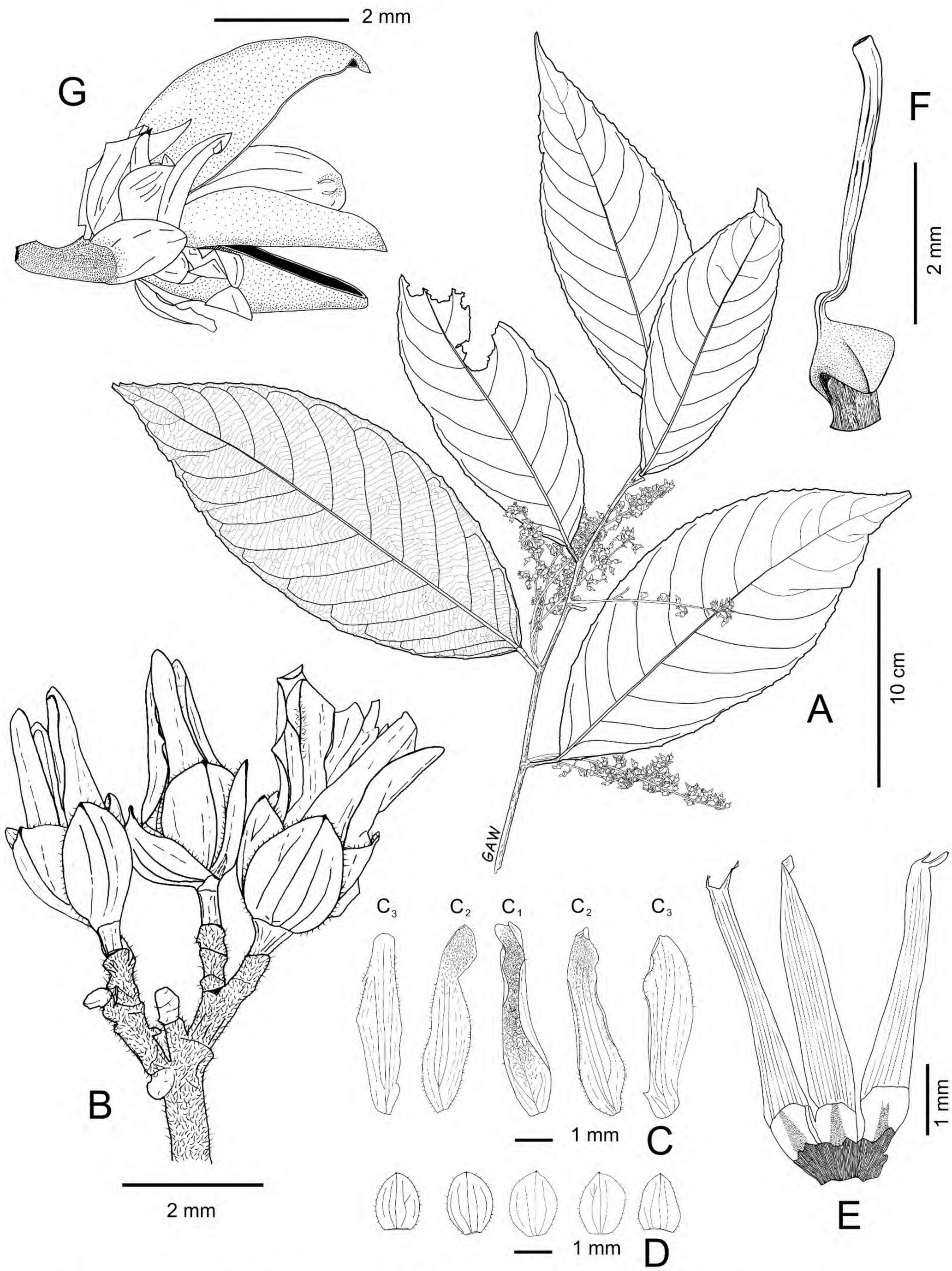

Figure 2. *Rinorea zygomorpha* H. E. Ballard & Wahlert. —A. Habit. —B. Lateral cymule. —C. Petals: C_1, anterior ("bottom") petal; C_2, lateral petals; C_3, posterior ("upper") petals. —D. Sepals. —E. Androecium, exterior view showing irregularly lacerate staminal tube, three anthers, and associated dorsal connective scales with bifid apices. —F. Ovary, showing developing apical "cap" and stipe. —G. Fruit, showing unequal valves and seed. A, B drawn from paratype, *D. Neill 8532* (MO); C–F drawn from holotype, *J. Korning & K. Thomsen 8610* (AAU); G drawn from paratype, *T. B. Croat 67467* (WIS).

surface glabrous; dorsal connective scales large and conspicuous, apical as well as lateral, lanceolate-ovate, orange, 2.7–3.2 × 0.9–1.1 mm, outer surface glabrous, margins entire except for distinctly bifid apex; ovary maturing after fertilization from an apical pale brown "cap" different in color and texture from ovary base; ovary "cap" becoming indurate, with deep and prominent sutures representing dehiscence lines of capsule, apex sparsely hirsute, blackish base persisting as stipe in mature capsule, eventually turning brown and converting to similar texture as rest of fruit, glabrous; style 2.8–3 mm, erect, filiform or subclavate, straight or sigmoid, apically curved, glabrous; stigmatic orifice apical, undifferentiated. Fruit a thick-walled hard capsule, dehiscent along 3 straight sutures, asymmetrically narrowly ovoid, 4.3–6.5 × 4.3–4.6 mm, strongly zygomorphic with 1 valve much broader than other 2; young fruits green, mature fruits tan to light brown, outer surface smooth, sparsely hirsute or glabrate near apex, apex obtuse; 1 seed per capsule, seed ca. 2.5 × 1.9 mm, globose in profile, laterally compressed with longitudinal furrow including funiculus, lateral attachment, tan, glabrous.

Distribution and habitat. *Rinorea zygomorpha* occurs in Ecuador and Peru, in lowland humid tropical rainforests, pastures, river terraces, and well-drained hills. It grows on red oxisols or acidic clay soils, from 150–450(800) m elevation. The species has also been collected in Panama and is expected in Colombia.

IUCN Red List category. An explicit conservation assessment following IUCN criteria (IUCN Standards and Petitions Working Group, 2008) was conducted following the general procedure outlined by Willis et al. (2004). This utilized a recently designed extension for ArcView GIS 3.2 software (Environmental Systems Research Institute, 1999) by Moat (2007). After placing the CATS (Conservation Assessment ToolS) extension in the main software folder for ArcView, georeferenced records representing all known localities for *Rinorea zygomorpha* were extracted from a BRAHMS (Botanical Research and Herbarium Management System) database (Filer, 2008) of Neotropical Violaceae and mapped to ArcView. The point data were analyzed by the CATS extension in three different ways to ascertain IUCN categories: the first analysis investigated all localities across the entire range of the species; the second and third analyses examined the disjunct Panamanian and South American points separately. The first, total range analysis with 23 records representing 13 distinct localities gave an extent of occurrence (EOO) estimate of 283,891.74 km² and area of occupancy (AOO) estimate of 157,944.53 km², with a recommended category in each case of Least Concern (LC). The second analysis examining only the two Panama records could only provide an AOO estimate of 177.04 km², which places the Panamanian localities in the Endangered (EN) category. The third analysis focusing on the 21 records representing 11 localities in the species' main range yielded an EOO of 34,436.58 km² and an AOO of 22,803.13 km², with recommended categories of Near Threatened (NT) and Least Concern (LC), respectively. Because the Panamanian specimens are not presently considered distinct at any taxonomic level from those in the main range, we accept the broader conclusion of Least Concern (LC) as an appropriate IUCN status for the species based purely on geographic range data. Additional corroborative evidence supporting this status includes the protective conditions provided to several populations in Ecuador within reserve boundaries of the Estación Biológica Jatun Sacha and Parque Nacional Yasuní.

Phenology. The species produces flower buds from July through November, mature open flowers from December through February, and mature fruits from September through February. It is possible that at least some of the "flower buds" on plants also bearing mature fruits in September and October are actually cleistogamous, but this requires further investigation to confirm the breeding system.

Etymology. The specific epithet *zygomorpha* refers to the strongly zygomorphic corollas of this species, a character that is unknown in all other Neotropical *Rinorea*.

Relationships. A maximum parsimony analysis of chloroplast *trnL* intron and *trnL-F* spacer sequences from 60 species of *Rinorea* from Latin America, Asia, and Africa shows the new species to occupy a near-basal position in a phylogeny of the genus (results not shown). *Rinorea zygomorpha* is placed in a moderately well-supported clade containing two other alternate-leaved Neotropical taxa: *R. bahiensis* (Moricand) Kuntze and *R. guianensis* (Wahlert & Ballard, unpublished data). This three-species clade corresponds to Hekking's (1988) informal infrageneric group Rinorea.

Paratypes. ECUADOR. **Morona-Santiago:** Morona, Cordillera de Cutucú, Centro Shuar Uunsuants/TransKutuku, 2°32′S, 77°53′W, 800 m, 20 Jan. 2002, *G. Toasa & M. Tirado 8664* (MO). **Napo:** Cantón Tena, Estación Biológica Jatun Sacha, Río Napo, 8 km al E de Misahuallí, Parcela Permanente 03, 1°04′S, 77°36′W, 400 m, 26 Dec. 1989, *C. E. Cerón M. & M. Montesdeoca 8138* (MO, U); Estación Biológica Jatun Sacha, 8 km al E de Misahuallí, 1°04′S, 77°36′W, 450 m, 17 Nov. 1988, *C. E. Cerón M. & C. Iguago 5623* (BHO, MO, U); Estación Biológica Jatun Sacha, Río Napo, 8 km al E de Misahuallí, 1°04′S, 77°36′W, 450 m, 28

July 1988, *D. Neill 8532* (MO); Estación Biológica Jatun Sacha, 1°04′S, 77°36′W, 450 m, 24 Aug. 1988, *C. E. Cerón M. & M. Cerón 4577* (U); Orellana, Yasuní National Park, Maxus petroleum pipeline rd., under construction, Km 18–26, 0°35′S, 76°30′W, 230 m, 11 Dec. 1993, *D. Neill, G. Tipaz & A. Dik 10276* (U); Canton Tena, Estación Biológica Jatun Sacha, 8 km al E de Misahuallí, Parc. Perm. 03-04-04, 1°4′S, 77°36′W, 400 m, 23 Jan. 1989, *C. E. Cerón M. 6120* (MO); Cantón Tena, Estación Biológica Jatun Sacha, Río Napo, 8 km al E de Misahuallí, junto al riachuelo Chinguipino, Parc. Perm. 03, arbol 04.04, 1°4′S, 77°36′W, 400 m, 26 Dec. 1989, *C. E. Cerón M. & M. Montesdeoca 8180* (MO); colecciones alrededor de reserva floristica "El Chuncho," aproximadamente 6 km de Río Payamino, 0°26′S, 77°06′W, 300 m, 15 Dec. 1987, *W. Palacios 2282* (BHO, MO, U); Orellana, Parque Nacional Yasuní, carretera y oleoducto de Maxus en construcción, Km 46–52, 0°47′S, 76°30′W, 250 m, 1 Sep. 1993, *M. Aulestia & J. Andi 382* (U); Orellana, Parque Nacional Yasuní, carretera y oleoducto de Maxus en construcción, Km 54–58, 0°48′S, 76°30′W, 250 m, 26 Sep. 1993, *M. Aulestia & N. Andi 732* (MO); Añangu, in the Parque Nacional Yasuní, 0°31′30″S, 76°23′W, 260–350 m, 24 Oct. 1983, *K. Thomsen & J. Korning 8618b* (AAU); Añangu, in the Parque Nacional Yasuní, 0°31′30″S, 76°23′W, 260–350 m, 14 Mar. 1983, *J. Lawesson, T. Lassø & P. M. Jørgensen 8618a* (AAU); Añangu, in the Parque Nacional Yasuní, 0°31′30″S, 76°23′W, 260–350 m, Dec. 1983, *J. Korning & K. Thomsen 8610* (AAU); NW corner of the Parque Nacional Yasuní, 0°32′S, 76°22′30″W, 300 m, 1 Oct. 1983, *J. Korning & K. Thomsen 47195* (AAU); Añangu, in the Parque Nacional Yasuní, 0°31′30″S, 76°23′W, 260–350 m, 1 Dec. 1983, *K. Thomsen & J. Korning 8618c* (AAU); Añangu, NW corner of the Parque Nacional Yasuní, along SEF line in terra firme forest, near Tiputini trail, 0°32′30″S, 76°22′30″W, 300 m, 14 Jan. 1985, *B. Øllgaard, J. Korning & K. Thomsen 57098* (U). PANAMA. **Coclé:** Penonomé–Coclecito, 5.6 mi. N of Llano Grande, along Río Cascajál, 1.4 mi. N of Continental Divide, 8°46′N, 80°27′W, 150 m, 11 Sep. 1987, *T. B. Croat 67467* (U, WIS). **Colón:** Santa Rita lumber rd., ca 16 km E of Colón, 9°18′N, 79°47′W, 5 Oct. 1969, *R. L. Dressler & W. H. Lewis 3734* (MO, U). PERU. **Amazonas:** Bagua Province, Distr. Imaza, Rio Cenepa region, region NO del Marion, Communidad Yamayakat, 4°55′S, 78°19′N [sic], 300 m, Jan. 1995, *V. Hodges & J. Gorham 64* (MO); Bagua Province, Yamayakat, Bosque de Rivera, 4°55′S, 78°19′W, 320 m, 4 Feb. 1996, *N. Jaramillo, M. Jaramillo & D. Chamit 1072* (MO); Bagua Distr., Soldado Oliva, 5°18′S, 78°20′W, 600 m, 6 Feb. 1999, *R. Vasquez, C. Vargas, J. Yactayo & E. Palomino 26026* (BHO, MO).

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A New Species of *Cyanus* (Asteraceae, Centaureinae) from Southeastern Bulgaria

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ABSTRACT. A new species of *Cyanus* Miller, *C. diospolitanus* Bancheva & S. Stoyanov (Asteraceae, Centaureinae), from Tundzha hilly country floristic region in Elhovo municipality, southeastern Bulgaria, is described and illustrated. It belongs to *Cyanus* sect. *Napuliferi* (Stefanoff & T. Georgiev) Bancheva & Raimondo, and taxonomically its closest relative is *C. pseudoaxillaris* (Stefanoff & T. Georgiev) Holub, a rare local endemic for the Thracian Plain, Bulgaria. The new species is currently known from four localities in the Derventski Hills (Yambol Province), growing at the periphery of dry, stony meadows in thermophilous oak forests and brushwood. The chromosome number is $2n = 22$, and SEM analysis of the pollen grains is described and illustrated.

Key words: Asteraceae, Centaureinae, *Cyanus*, IUCN Red List, sect. *Napuliferi*.

During floristic investigation in the Derventski Hills in Elhovo municipality, southeastern Bulgaria (Yambol Province), involving the mapping of priority habitats according to the Natura 2000 criteria (<http://www.natura.org>), a new species from *Cyanus* Miller (Asteraceae, Centaureinae) was found. The species has narrowly fusiform roots that shrink upon drying and consequently belongs to *Cyanus* sect. *Napuliferi* (Stefanoff & T. Georgiev) Bancheva & Raimondo (Bancheva & Raimondo, 2003). In contrast to all other perennial *Cyanus*, the new species has branched stems and numerous small capitula.

According to Greuter (2008), *Cyanus* comprises 29 species. Its center of diversity is in Turkey, southeastern Europe, and the Caucasus (Meusel & Jäger, 1992). *Cyanus* sect. *Napuliferi* includes eight species, seven of which are distributed in Bulgaria. The group is well distinguished by having fusiform or napiform roots, reduced leaf size, and leaf blades that are frequently deeply cut and with white-lanate hairs (Bancheva & Raimondo, 2003).

Living plants of the new species were examined in the field. Morphological characters were noted from herbarium material of personal collections and of the type collection. The karyotype was studied from mitotic metaphase obtained from root tips of three plants collected in the wild from the type locality. Root tips were pretreated with 8-oxychinoline for 30 min., then fixed in acetic alcohol (1:3) for 24 hr. at 4°C, hydrolysed in 1 mol/L HCl for 15 min. at 60°C, stained with hematoxylin according to Gomori (Melander & Wingstrand, 1953) for 30 min. at 60°C, and squashed in 45% acetic acid. The karyotype has been determined according to Levan et al. (1964) on the basis of eight metaphase plates. The pollen morphology was studied by scanning electron microscopy (SEM) according to Huttunen and Laine's protocol (1983).

Cyanus diospolitanus Bancheva & S. Stoyanov, sp. nov. TYPE: Bulgaria. Yambol Prov.: Elhovo mun., Tundzha hilly country floristic region, Derventski Hills, ca. 2 km SW of village of Vulcha Polyana, 41°59′58.9″N, 26°39′26.2″E, 370 m, 23 May 2006, *S. Bancheva & S. Stoyanov 163344* (holotype, SOM; isotypes, MO, SOM 163343, W, WU). Figure 1.

Haec species ab affini *Cyano pseudoaxillari* (Stefanoff & T. Georgiev) Holub capitulis numerosis (7 ad 28 nec

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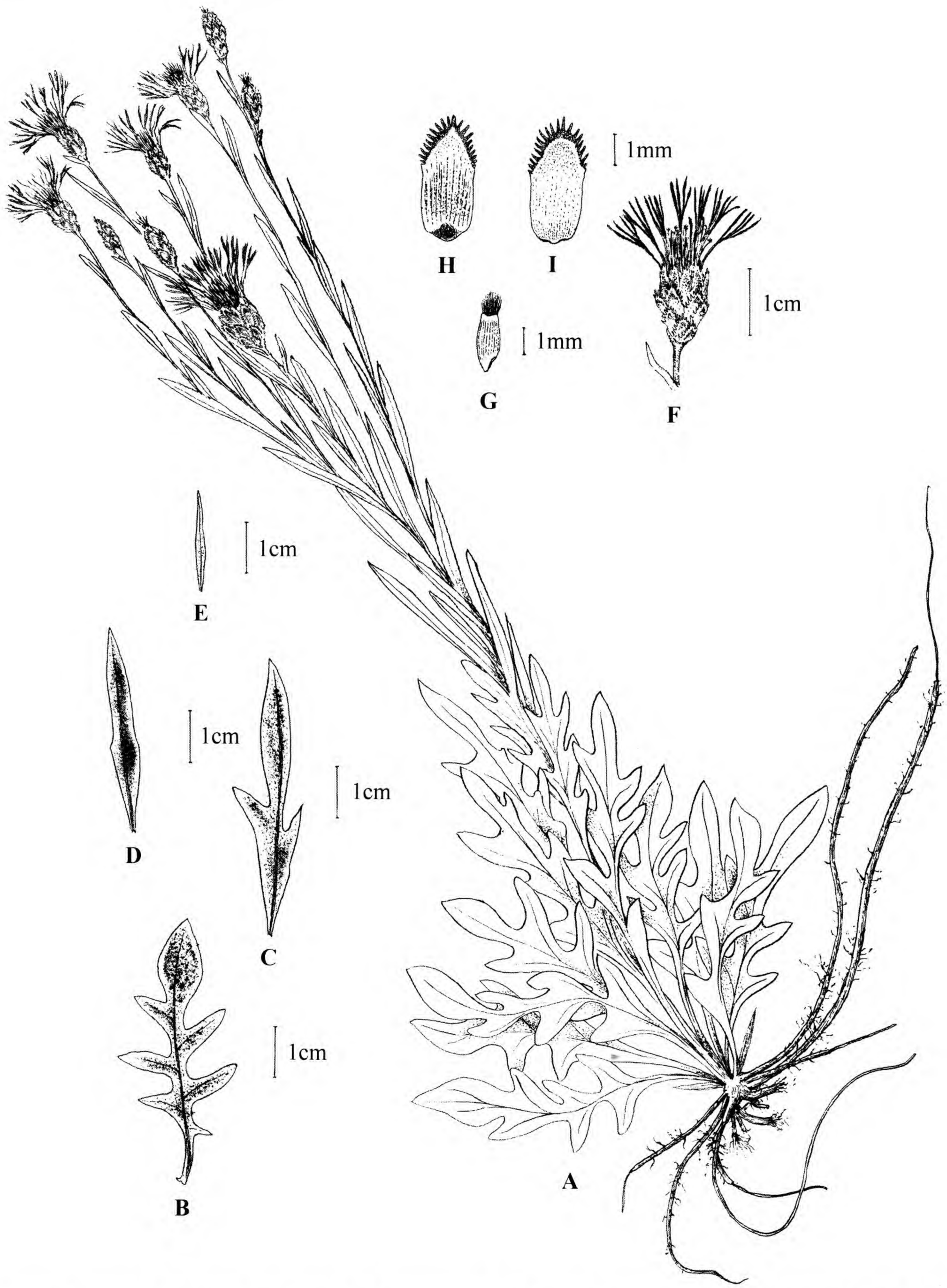

Figure 1. *Cyanus diospolitanus* Bancheva & S. Stoyanov. —A. Habit. —B. Rosette leaf. —C. Lower cauline leaf. —D. Median cauline leaf. —E. Upper cauline leaf. —F. Capitulum. —G. Achene. —H. Median phyllary from the second involucral row. —I. Median phyllary from the third involucral row. Drawn from the holotype *Bancheva & Stoyanov 163344* (SOM).

solitario) minoribus angustius cylindricis (5–7[–10] mm nec 13–20 mm latis) atque fimbriis appendicum phyllariorum brevioribus ([0.3–]0.5–0.7[–1] mm nec 2–3 mm longis) differt.

Herbaceous perennial plant; roots 15–20 × 0.6–0.7 cm, narrowly fusiform with very long, slender apices (that shrink upon drying); stems to 70 cm high, erect, branched above the middle, with many capitula (7 to 28). Lower leaves in basal rosette, 13–15 × 3–5 cm, arachno-tomentose, lyrate-pinnatisect, remotely dentate, with 3 lanceolate-triangular, 1.8–3 × 0.8–1 cm teeth on each side; upper stem leaves lanceolate-linear, 3–7 × 0.3–0.4 cm. Capitula small, 13–16 × 5–7(–10) mm; phyllaries triangular-ovoid, arachno-tomentose, green to violet, with decurrent fimbriate margins; appendages triangular-ovoid to ovoid, brown to blackish brown, fimbriate; appendage margin below the fimbriae (0.1–)0.3–0.5(–0.9) mm wide, fimbriae (0.3–)0.5–0.7(–1) mm long. Florets ca. 12–15 mm, purple-violet to cornflower blue; marginal florets longer, radiate, sterile, with linear laciniae ca. 1/2 as long as tube; anther tube of fertile florets exserted, pinkish violet. Achenes asymmetrically cylindrical-truncate, 4–4.5(–5) × 1.5–2 mm, yellowish or pale brown, with lateral elaiosome, ca. 0.5 × 0.3 mm; pappus multiseriate, 1.5–2 mm, pale brown.

Distribution and ecology. *Cyanus diospolitanus* is currently known from four localities in the Tundzha hilly country of Elhovo municipality in southeastern Bulgaria (Yambol Province), near the villages of Chernozem, Vulcha Polyana, Lesovo, and Malko Kirilovo. The new species was observed to grow at the periphery of dry, stony meadows in thermophilous oak forests and brushwood, at altitudes up to 500 m. It is also likely that *C. diospolitanus* would be found in northwestern Turkey, close to the Bulgarian border. This area falls within the Continental climate zone, characterized by a mean January temperature of 1°C, a mean July temperature of 23°C, and an annual precipitation of 500 mm with an autumn–winter maximum (Nikolova et al., 2002). According to the Food and Agriculture Organization of the United Nations (FAO) classification (FAO, 1988), soils such as lithic leptosols (LPq) and chromic luvisols (LVx) are most common in the investigated area (Ninov, 2002).

The Derventski Hills are a Site of Community Importance as part of the European ecological network Natura 2000. The habitat type "Eastern white oak forests–91AA," where *Cyanus diospolitanus* is found, is included in Annex I of the "Habitat" Directive 92/43/EEC.

Cyanus diospolitanus grows together with *Ajuga laxmannii* (L.) Bentham, *Anemone pavonina* Lamarck, *Astragalus spruneri* Boissier, *Bituminaria bituminosa* (L.) C. H. Stirton, *Bothriochloa ischaemum* (L.) Keng, *Buglossoides arvensis* (L.) I. M. Johnston, *Calepina irregularis* (Asso) Thellung, *Carex caryophyllea* Latourrette, *C. flacca* Schreber, *Carpinus orientalis* Miller, *Cerastium semidecandrum* L., *Chrysopogon gryllus* (L.) Trinius, *Clinopodium vulgare* L., *Clypeola jonthlaspi* L., *Comandra elegans* (Rochel ex Reichenbach) Reichenbach f., *Crataegus monogyna* Jacquin, *Cruciata laevipes* Opiz, *Cyanus thirkei* (Schultz Bipontinus) Holub, *Erysimum diffusum* Ehrhart, *Euonymus verrucosus* Scopoli, *Euphorbia myrsinites* L., *Geranium sanguineum* L., *Helianthemum nummularium* Miller, *Iris pumila* L., *Lathyrus laxiflorus* (Desfontaines) Kuntze, *Leontodon crispus* Villars, *Luzula forsteri* DC., *Mercurialis ovata* Sternberg & Hoppe, *Muscari neglectum* Gussoni ex Tenore, *Ornithogalum fimbriatum* Willdenow, *O. umbellatum* L., *Paliurus spina-christi* Miller, *Paeonia peregrina* Miller, *Polygonatum odoratum* (Miller) Druce, *Potentilla micrantha* Ramond ex DC., *Prunella vulgaris* L., *Quercus cerris* L., *Q. pubescens* Willdenow, *Ranunculus ficaria* L., *R. millefoliatus* Vahl, *Scorzonera mollis* M. Bieberstein, *Sedum hispanicum* L., *Thlaspi perfoliatum* L., *Verbascum phoeniceum* L., *V. xanthophoeniceum* Grisebach, *Veronica multifida* L., *Vinca herbacea* Waldstein & Kitaibel, *Viola odorata* L., and *V. sieheana* Becker.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), *Cyanus diospolitanus* should be classified as Critically Endangered (CR B1ab[i,ii,iii]+2ab[i,ii,iii]). At present, the new species is known from four localities with an area of occupancy about 3 km² and an area of distribution about 80 km². The total population is estimated at ca. 800 mature individuals, and the subpopulations are severely fragmented. The major source of threat to the populations is the anthropogenic activity in and around the known collection localities. The felling of the thermophilous oak forests for economic purposes leads to an irreversible loss of the specific habitat to which the species is connected. Some possible measures for conservation of *C. diospolitanus* should be taken, such as the creation of a protected area between Lesovo customs house and Vulcha Polyana, with elaboration of an action plan.

Phenology. The new species is known to flower in May and fruit in June.

Karyotype. $2n = 2x = 18$ submetacentric + 4 subtelocentric with satellites = 22. The chromosomes are generally small, ca. 1.5–2 μm (Fig. 2A). The basic chromosome numbers of *Cyanus* known so far are x = 12, 11, 10, 9, and 8 (Hellwig, 2004). The members of

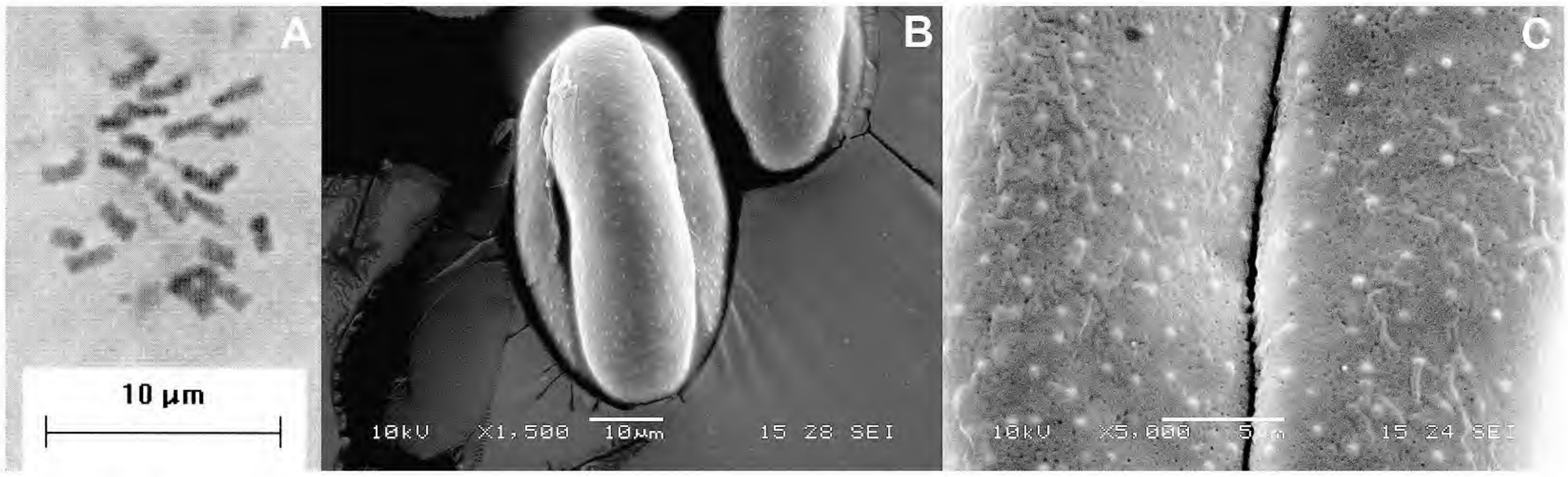

Figure 2. *Cyanus diospolitanus* Bancheva & S. Stoyanov. —A. Slide view of metaphase chromosomes, $2n = 22$. —B. Pollen grain. —C. Surface detail of pollen grain.

section *Napuliferi* investigated to date have $x = 11$ and 10. The similar diploid number of $2n = 22$ has been found in *C. pseudoaxillaris* (Bancheva & Raimondo, 2003).

Pollen. Pollen grains are of Wagenitz's *Centaurea montana* L.-type (1955), prolate, with the correlation of the polar axis to the equatorial diameter of 1.7. The exine sculpture is scabrate, with the density of the sculpture elements being 5 to 8 per 25 μm^2. Measurements include equatorial diameter 30 ± 1.3 µm; polar axis 50 ± 3.2 µm; mesocolpium 12.8 ± 1.6 µm; apocolpium 8.5 ± 1.1 µm; length of the colpus 41.5 ± 3.4 µm; and breadth of the colpus 1.6 ± 0.6 µm (Fig. 2B, C).

Reproductive biology. *Cyanus diospolitanus* is an outcrossed species that is pollinated by ants and other insects. During field observation, we noticed many drops of a sugary syrup on the borders of the involucral phyllary appendages, which attracted ants. Ants are also important for the dispersal of the diaspores (myrmecochory). The achenes have well-developed lateral elaiosomes that are rich in oil and are a food source for ants.

Etymology. The species epithet refers to Diospolis, the ancient name of the city of Yambol. It is a city in southeastern Bulgaria and the administrative center of Yambol Province, which is the main area of distribution of the new species.

Relationships. Based on morphological characters and a basic chromosome number of $x = 11$, the closest relative of the new species *Cyanus diospolitanus* is *C. pseudoaxillaris*, an equally rare species of very local distribution on the Thracian Plain in Bulgaria. The new species differs from *C. pseudoaxillaris* and from *C. thirkei* (which is found as an associate at the collection localities) by its branched stems, numerous small capitula, and finer fimbriae of the appendages (Table 1).

Paratypes. BULGARIA. Yambol Prov.: Elhovo mun., Tundzha hilly country floristic region, Derventski Hills, S of village of Chernozem, 42°05′31.6″N, 26°35′34.4″E, 24 June 2005, *S. Bancheva & S. Stoyanov 163348, 163349* (SOM); NE of Lessovo customs house, 22 May 2006, *Bancheva & S. Stoyanov 163345, 163346* (SOM); SE of village of Malko Kirilovo, 16 May 2005, *Bancheva & S. Stoyanov 163347* (SOM).

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Table 1. Morphological comparison of the new species *Cyanus diospolitanus* with *C. pseudoaxillaris* and *C. thirkei*.

Character	*C. diospolitanus*	*C. pseudoaxillaris*	*C. thirkei*
Plant height (cm)	to 70	to 30	5–10(–15)
Root length (cm) and shape	to 20, fusiform	to 20, fusiform	to 2–3, napiform or fusiform
Capitulum number per plant	7 to 28	1	1
Involucrum width (mm)	5–7	13–20	16–20
Fimbriae length (mm)	0.5–0.7	2–3	2–3
Color of the florets	purple-violet to cornflower blue	purple-violet	whitish

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Psychotria perotensis (Rubiaceae, Psychotrieae), a New Species from the Montane Cloud Forest in Veracruz, Mexico

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Abstract. *Psychotria perotensis* Castillo-Campos, belonging to subgenus *Heteropsychotria* Steyermark (Rubiaceae, Psychotrieae), is described and illustrated as a new species from the region of La Cortadura, Coatepec, on the eastern slopes of the volcano Cofre de Perote, Veracruz, Mexico. This species is related to *P. phanerandra* (Standley & Steyermark) Lorence and *P. galeottiana* (M. Martens) C. M. Taylor & Lorence; however, it differs from these species in its larger leaves and inflorescence.

Resumen. Se describe e ilustra *Psychotria perotensis* Castillo-Campos perteneciente al subgénero *Heteropsychotria* Steyermark (Rubiaceae, Psychotrieae) como una especie nueva de la región La Cortadura, Coatepec, en las faldas orientales del volcán Cofre de Perote, Veracruz, México. Esta especie muestra similitudes con *P. phanerandra* (Standley & Steyermark) Lorence y *P. galeottiana* (M. Martens) C. M. Taylor & Lorence; sin embargo, difiere por el tamaño de las hojas y de la inflorescencia.

Key words: Mexico, *Psychotria*, Psychotrieae, Rubiaceae, Veracruz.

Psychotria L. is one of the largest genera, and probably one of the most taxonomically complex, of the family Rubiaceae, containing more than 1000 species distributed in the tropics and subtropics of the world (Standley & Williams, 1975; Dwyer, 1981; Burger & Taylor, 1993; Taylor et al., 2007). This genus is also one of the best represented in Mexico, with approximately 44 recognized species of trees and shrubs, of which six are endemic to the country (Lorence & Dwyer, 1987).

The genus *Psychotria* is generally divided into two subgenera: *Psychotria* L. and *Heteropsychotria* Steyermark (Steyermark, 1972; Standley & Williams, 1975; Andersson, 2001, 2002). The two subgenera can be easily distinguished: in the subgenus *Psychotria*, of Pantropical distribution, the stipules are deciduous and the fruit red when ripe; while in the subgenus *Heteropsychotria*, which is restricted to the Neotropics, the stipules are perennial and the fruit generally white, blue, or purple at maturity (Lorence & Dwyer, 1987; Hamilton, 1989; Nepokroeff et al., 1999; Andersson, 2001, 2002; Taylor et al., 2007). Due to its perennial stipules and blue or purple fruits, the new species *Psychotria perotensis* belongs to the latter subgenus.

Intensive collections have been carried out during recent explorations in the montane cloud forest in the area of La Cortadura, municipality of Coatepec, Veracruz, Mexico. These have resulted in the collection of rare and characteristic species of this particular vegetation type, such as *Illicium mexicanum* A. C. Smith (Illiciaceae) and *Drimys granadensis* L. f. var. *mexicana* (DC.) A. C. Smith (Winteraceae) (Garcia-Franco et al., 2008), as well as others such as *Piper xanthostachyum* C. DC. (Piperaceae) and *Ponthieva brenesii* Schlechter (Orchidaceae), which hitherto have been unreported in Veracruz (Castillo-Campos et al., 2009). Several collections of a *Psychotria* with white flowers were made in the montane cloud forest that appeared to be an undescribed species, which we describe here.

Psychotria perotensis Castillo-Campos, sp. nov. TYPE: Mexico. Veracruz: Mpio. Coatepec, La Cortadura, eastern slopes of the volcano Cofre de Perote, montane cloud forest, 2250 m, 10 Sep. 2007, *G. Castillo-Campos & Jesús Pale Pale 22827* (holotype, XAL; isotypes, ENCB, MEXU, MO). Figures 1, 2.

Frutex vel arbuscula glabra. Stipulae persistentes minute biaristatae; folia petiolata, glabra, lamina elliptico-ovali, 5–15 × 1.5–6 cm, venis secundariis 5 ad 13 paribus.

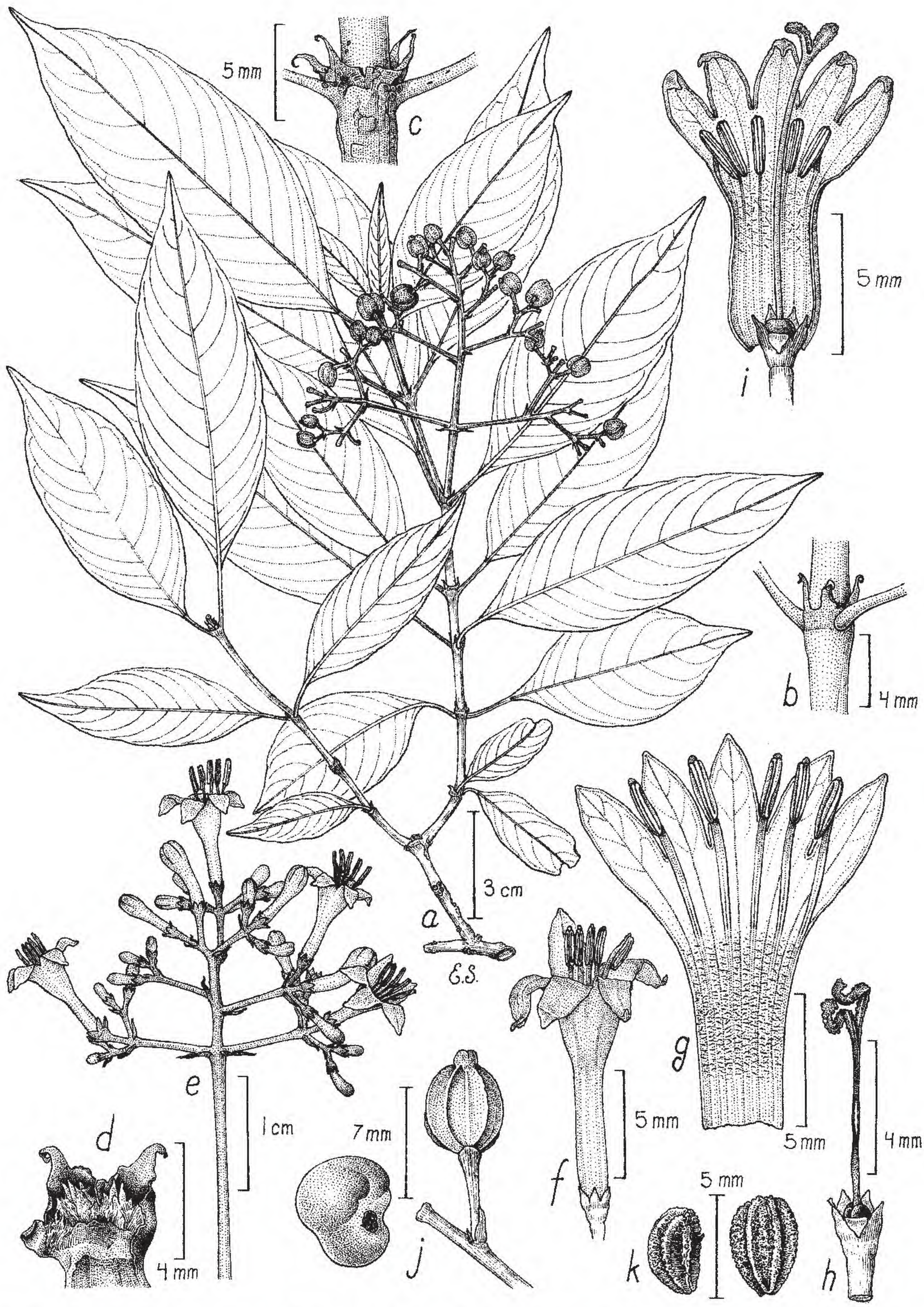

Figure 1. *Psychotria perotensis* Castillo-Campos. —A. Branch showing insertion and arrangement of leaves on the branches. —B, C. Node with stipules in young (B) and old (C) branches. —D. Stipule with colleters. —E. Inflorescence. —F. Flower. —G. Insertion of the stamens in the corolla. —H. Style. —I. Fully dissected flower. —J. Fruit. —K. Immature (right) and mature (left) seeds. Drawn from the holotype *G. Castillo-Campos & J. Pale Pale 22827* (XAL).

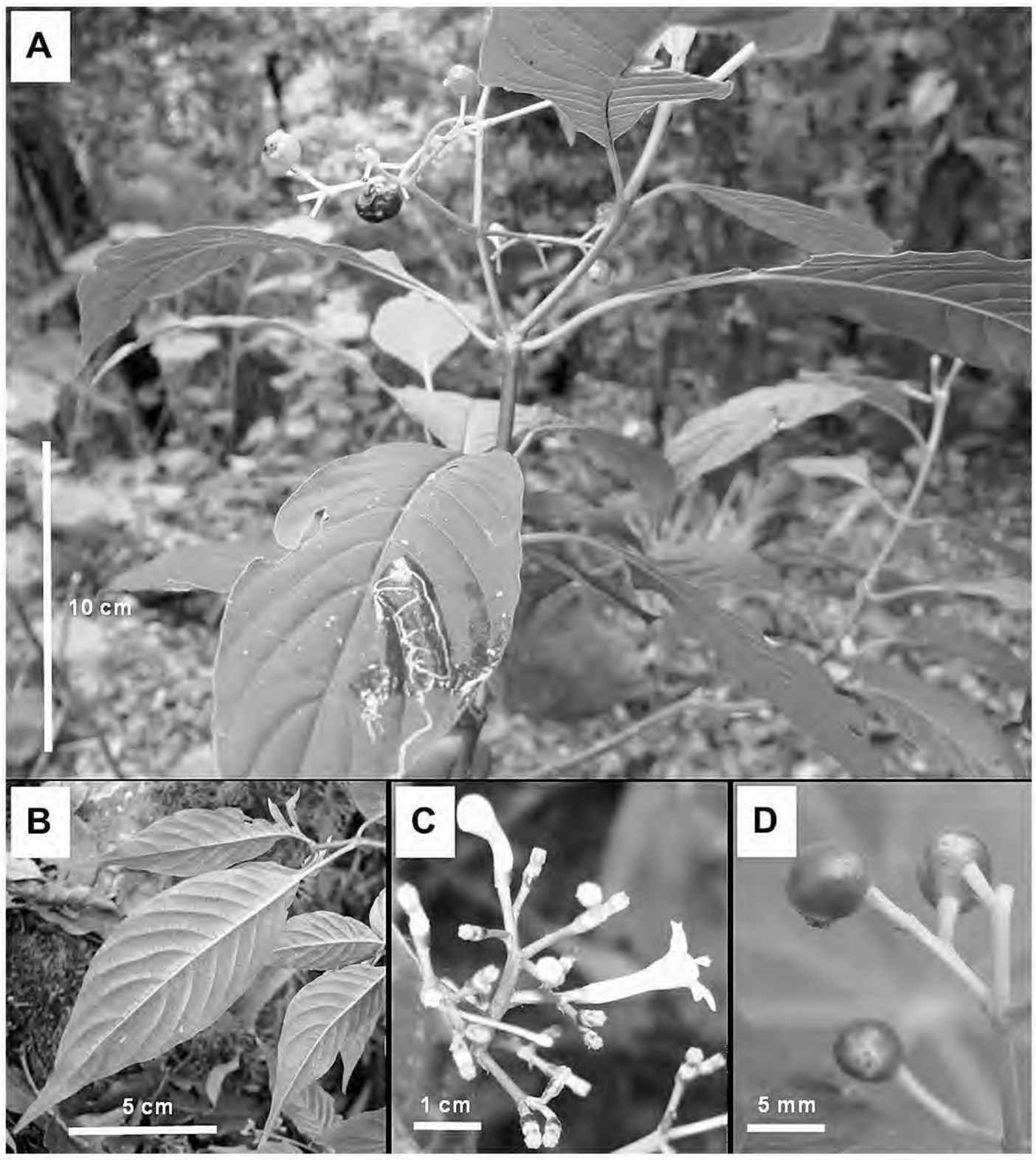

Figure 2. *Psychotria perotensis* Castillo-Campos. —A. Branch with ripe and unripe fruit. —B. Sheets showing the venation of the abaxial leaf surface. —C. Inflorescence with long-styled flowers. —D. Infructescence with unripe fruit.

Inflorescentia terminalis vel subterminalis, glabra, paniculata, 3.7–8.5 cm longa, pedunculo 3.1–7.2 cm longo rubello. Flos calyce viridi-rubello, corollae tubo 4.8–11 mm longo albo. Fructus subglobosus caeruleus vel niger in maturitate, didymus, 4–7 × 4–7(–9) mm, 4- ad 8-costatus in siccitate, saepe loculum unum abortivum efferens.

Shrubs or *small trees* 0.6–5 m tall, green in young terminal branches, brown in old branches, shiny when dry, cylindrical stems, internodes 1–3.3 cm, glabrous, with constrictions at the nodes above the young stems when dry and turgid, reddish when fresh; *stipules* perennial, interpetiolar, 2 per node, green in young branches, brown in old branches, shiny, biaristate, deltoid, ascending, acute at apex, apex commonly retrorse, hairs in interior base and with colleters forming a white collar in the adaxial base, associated with pubescence, 0.3–1 mm long, 0.1–0.2 mm thick, externally glabrous, 2–3 × 1.8–3 mm. *Leaves* simple, opposite, petiolar, glabrous, adaxially dark green, abaxially light green, lamina elliptic-oval, 5–15 × 1.5–6 cm, papyraceous, venation mixed craspedodromous, impressed adaxially, prominent abaxially, 5 to 13 pairs of secondary veins, apex acuminate, 1–1.5 cm, margin entire, slightly repand, base attenuate, petiole 0.7–2.5 cm × 0.6–1 mm, green when dry, reddish when fresh in young leaves, shiny. *Inflorescences* terminal or lateral in new branches, 3.7–8.5 × 4–7 cm, 15 to 40 flowers, paniculate, main stem 31–72 × 0.7–1.2 mm, secondary axes 11–26 × 0.5–0.8 mm, brown or reddish, shiny, bracts linear to triangular, glabrous, 1–5.4(–22) × 0.2–1.2(–2.1) mm, margin entire, apex acute, base obtuse; bractlets triangular to linear, glabrous, 0.5–1.1 × ca. 0.4 mm, margin entire, apex acute, base obtuse; pedicel 0.5–7 × 0.2–0.6 mm, occasionally almost sessile. *Flowers* white, *calyx* tubular, calyx cup 1.4–1.8 × 0.5–0.8 mm, 5-lobate, reddish green, dark on drying, lobes 0.5–1.2 × 0.4–0.6 mm, margin dentate or entire, apex acute, corolla tube white, glabrous, tube 4.8–11 × 0.7–2 mm in the middle part of corolla, corolla throat internally villous, externally glabrous, lobes generally 5, glabrous, white, often recurvate, 2–4.5 × 1–2.5 mm from the base, margin entire, apex rounded or acute; *stamens* 5, petalostemonous, subsessile or filamentous, filaments 2.2–3 × ca. 0.2 mm, glabrous, anthers 1.3–2.3 × 0.2–0.3 mm, slightly exserted; *style* short, slender, glabrous, 6–11 × 0.1–0.3 mm, included in corolla tube, the length exserted 8.3–11.7 × 1–3 mm, glabrous; stigma bifid, papillate,

Table 1. Morphological similarities and differences between *Psychotria phanerandra*, *P. perotensis*, and *P. galeottiana*.

Character	*P. phanerandra*	*P. perotensis*	*P. galeottiana*
Life form, maximum height (m)	4	5	5
Internode length (cm)	1.5–4.5	1–3.3	2–4.5
Leaf			
Form	elliptic to ovate-elliptic	elliptic-ovate	elliptic to broadly elliptic
Pubescence	puberulent to glabrous	glabrous	glabrous, pubescent on main abaxial veins to densely pilose to strigillose
Length (cm)	4–10(–12.5)	5–15	4–15
Width (cm)	(1.8–)2.5–4.7	1.5–6	1.2–4
Apex	acuminate, 2 cm long	acuminate, 1–1.5 cm long	acute or acuminate, 1–2 cm long
Base	acute or cuneate, often attenuate	attenuate	acute or cuneate to rotundate
Venation			
Pairs of primary veins	5 to 8(10)	5 to 13	7 to 18
Venation type	eucamptodromous	mixed craspedodromous	camptodromous to eucamptodromous
Prominence	both sides	abaxially	abaxially
Petiole length (cm)	(0.15–)0.3–1	0.7–2.5	0.2–1.7
Flowers			
Number	15 to 22	15 to 40	5 to 11
Color	yellow	white	white or pink
Stamen	4 to 5	5	5
Filaments	glabrous	villous, petalostemonous	glabrous
Pedicel length (mm)	0–1.5	0.5–7	0–5
Fruit			
Form	ovoid, ellipsoid, or subglobose, frequently didymous and laterally complanate	frequently didymous, subglobose	ellipsoid, sometimes laterally complanate
Length (mm)	5–7	4–7	3–4
Width (mm)	5–6.5	4–7	3–4
Stones or seeds, number	2 frequently, 1 aborted	2 frequently, 1 aborted	2
Costae, number	3 to 5	4 to 8	4 to 5

0.5–2 × 0.5–0.8 mm. *Fruit* pyrenocarpous, often didymous, subglobose, green, with 1 or 2 seeds, blue or black on ripening, black on drying, shiny, glabrous, from 1 to 23 per inflorescence, 4- to 8-costate when dry, costae 4–7 mm; *persistent calyx*, 4–7(–9) mm diam., pedicel 0.5–8 × 0.2–0.7 mm, green when fresh, brown when dry, shiny, main stalk glabrous, 31–60 × 0.6–1.7 mm, secondary axes glabrous, 6–29 × 0.5–2.2 mm, bracts linear, glabrous, 0.6–8.5(–35) × 0.2–0.6(–2.5) mm, apex acute, base obtuse, margin entire; bractlets triangular, glabrous, 0.7–1.5 × 0.2–0.5 mm; *seeds* 1 to 2, slightly arcuate, 4–4.3 × 2–2.3 mm, cream colored, 4-costate, 2 prominent, often an aborted seed.

Distribution. Despite extensive inspections of other forested areas of Veracruz, the specimens collected so far suggest that distribution of *Psychotria perotensis* is restricted to the montane cloud forest on the eastern slopes of the volcano Cofre de Perote, in the center of the state of Veracruz. Therefore, it is likely that this species is endemic to the state of Veracruz.

Habitat. *Psychotria perotensis* is a common species in the understory of the well-preserved montane cloud forest of La Cortadura. This habitat has a semi-humid climate and is the warmest climate found in temperate areas, with average annual temperatures of over 18°C (García, 2004). Within the arboreal stratum, *P. perotensis* is associated mainly with the trees *Drimys granadensis* var. *mexicana*, *Liquidambar styraciflua* L., *Podocarpus matudae* Lundell, *Prunus samydoides* Schlechtendal, *Quercus corrugata* Hooker, *Q. laurina* Bonpland, and *Rhamnus longistyla* C. B. Wolf. Within the shrub stratum, the most common taxa are *Bernardia interrupta* (Schlechtendal) Müller Argoviensis, *Deppea grandiflora* Schlechtendal, *Hoffmannia excelsa* (Kunth) K. Schumann, and *Moussonia deppeana* (Schlechtendal & Chamisso) Hanstein. The

herb stratum is characterized by a diversity of ferns, chief among which are *Arachniodes denticulata* (Swartz) Ching, *Asplenium auriculatum* Swartz, and *Blechnum falciforme* (Liebmann) C. Christensen, as well as species such as *Greigia van-hyningii* L. B. Smith and *Piper xanthostachyum*.

IUCN Red List category. *Psychotria perotensis* is known locally as "jihuite" and is a forage species, being very palatable to goats. In the study area, it is associated with *P. galeottiana* (M. Martens) C. M. Taylor & Lorence and *P. nervosa* Swartz. *Psychotria galeottiana* also belongs to subgenus *Heteropsychotria*, while *P. nervosa*, which has red fruit, belongs to subgenus *Psychotria*. Therefore, two subgroups of the same genus coexist in the La Cortadura, one Neotropical and the other Pantropical. Although population levels of *P. perotensis* appear to be adequate, its habitat is limited to well-preserved montane cloud forests. These forests may be considered endemic to the center of the state of Veracruz due to their restricted distribution, and therefore *P. perotensis* could be considered Vulnerable (VU B1a; C2) according to IUCN Red List criteria (IUCN, 2001) because these original fragments of montane cloud forest are small and unprotected.

Phenology. Flowering in *Psychotria perotensis* is from February to May and fruiting from July to October. Both flowering and fruiting are irregular, varying between individuals during each season.

Etymology. The epithet refers to the volcano Cofre de Perote, one of the highest mountains in the state of Veracruz, where the species grows on the eastern slopes.

Discussion. Due to the great diversity of species of the genus *Psychotria*, an exhaustive review was carried out in order to confirm that *P. perotensis*, of montane cloud forest, is a new taxon, and that *P. galeottiana*, also of montane cloud forest, and *P. phanerandra* (Standley & Steyermark) Lorence, of the tropical evergreen rainforest in southern Veracruz, Oaxaca, Chiapas, and Tabasco (Lorence & Dwyer, 1987; Taylor & Lorence, 1992), are the morphologically closest species. *Psychotria perotensis* is similar to *P. phanerandra* and *P. galeottiana* in habit, leaf shape, floral dimorphism (distyly), flower color, and the shape, size, and color of the fruit. However, it differs from *P. galeottiana* in leaf pubescence, number of primary nerves and flowers per inflorescence, indumentum of the stamen filaments, pedicel length, and number of ribs of the fruit. It also differs from *P. phanerandra* in leaf pubescence and size, number of primary veins, prominence of venation, petiole length, color and number of flowers per inflorescence, pedicel length, and in the number of ribs of the dry fruits and seeds (Table 1).

Paratypes. MEXICO. **Veracruz:** Mpio. Coatepec, La Cortadura, local nature reserve, E slope of the volcano Cofre Perote, 2200 m, *G. Castillo-Campos & M. J. Peralta 21415* (ENCB, XAL), *21506* (MEXU, XAL), *21796* (XAL), *22289* (XAL), *22441* (ENCB, MEXU, XAL), *G. Castillo-Campos & J. Pale Pale 22702* (ENCB, MEXU, MO, XAL), *22703* (ENCB, MEXU, XAL), *22705* (ENCB, MEXU, MO, XAL), *22737* (XAL), *22746* (ENCB, MEXU, MO, XAL), *22750* (XAL), *22868* (ENCB, MEXU, XAL), *G. Castillo-Campos & R. Madrigal 22907* (ENCB, MEXU, MO, XAL), *22942* (XAL), *22943* (ENCB, MEXU, MO, XAL), *22944* (MEXU, XAL), *22946* (ENCB, MEXU, XAL), *23381* (XAL), *23383* (XAL), *23384* (XAL).

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A New Variety of *Salvia sericeotomentosa* (Lamiaceae) from South Anatolia, Turkey

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Abstract. *Salvia sericeotomentosa* Rechinger f. (Lamiaceae) was first collected by A. Eig and M. Zohary in 1932 and was described in 1952 by K. H. Rechinger, but since that time it has not been collected again from its type locality. Among specimens collected from the Amanos Mountains near Hatay Province, Turkey, in 2006, the taxon was rediscovered on the basis of two different populations growing at low altitudes. These populations provide the type for the new variety *S. sericeotomentosa* var. *hatayica* Celep & Doğan, which differs from the typical variety by having densely sericeous-tomentose and short glandular-pilose inflorescences. A full description of the new variety is also provided, as well as its conservation assessment.

Key words: Hatay Province, IUCN Red List, *Salvia*, Turkey.

The first revision of *Salvia* L. (Lamiaceae) in Turkey was made by Hedge (1982a) in Davis' *Flora of Turkey and the East Aegean Islands*, in which 86 species were recognized. Since 2005, extensive field surveys and laboratory studies have been conducted on *Salvia* in Turkey by the authors. These studies revealed two additional new species, *S. marashica* İlçim, Celep & Doğan (İlçim et al., 2009) and *S. ekimiana* Celep & Doğan (Celep & Doğan, 2009); two new records, *S. viscosa* Jacquin (Celep et al., 2009) and *S. macrosiphon* Boissier (Kahraman et al., 2009); and now one additional new taxon is also recognized.

The type of *Salvia sericeotomentosa* Rechinger f. was collected by A. Eig and M. Zohary from northern Hatay Province in Turkey in 1932 and described as a new species by K. H. Rechinger in 1952 (Rechinger, 1952). Hedge (1982a) later accepted this species as a local endemic growing in the Mediterranean region of Turkey. Between 2005 and 2006, the authors visited the type locality of *S. sericeotomentosa* as well as a number of other sites where it might potentially occur. Despite these expeditions, *S. sericeotomentosa* was not found from its type locality or the surrounding area. Our field and herbarium surveys have indicated that the species has not been collected since the original type collection. Specimens identified to this species were collected by the authors from the Amanos Mountains above Samandağ from southern Hatay Province in Turkey in 2006. These specimens were first identified with the keys provided by Hedge (1982a) in Davis' *Flora of Turkey and the East Aegean Islands* and other relevant floras, including Rechinger (1952, 1963), *Flora Iranica* (Hedge, 1982b), and *Flora of Cyprus* (Hedge, 1985). They were cross-checked with the collections cited in the flora as well as material housed at various herbaria (AEF, ANK, BM, E, G, GAZI, HUB, ISTE, ISTF, K, and W). After careful examination, some specimens had a distinctive, densely sericeous-tomentose and glandular-pilose indument on their inflorescences, while all remaining material had glabrous inflorescences. Rechinger's (1952) protologue noted a glabrous inflorescence, and this has been confirmed by our examination. Our field observations demonstrated that both glabrous and pubescent populations may occur in the same locality, and it therefore seems reasonable to treat these as different varieties.

In Rechinger's 1952 protologue, flower color and seed characteristics were not properly indicated for *Salvia sericeotomentosa*, probably due to lack of proper material. Therefore, a full description of the new variety is given here on the basis of firsthand observations made in the field and herbarium.

1. Salvia sericeotomentosa Rechinger f., Oesterr. Bot. Z. 99: 52. 1952. TYPE: Turkey. Hatay: Achagi Zarkoun [Aşağı Zorkun], Amanus, ascent to Achagi Zarkoun, from the Karakisieh side, 800–1000 m, 30 June 1932, *A. Eig & M. Zohary s.n.* (holotype, S; isotypes, E, HUJ).

1a. Salvia sericeotomentosa var. **sericeotomentosa.**

1b. Salvia sericeotomentosa var. **hatayica** Celep & Doğan, var. nov. TYPE: Turkey. Hatay: Samandağ to Arsuz, among *Quercus coccifera* shrubs, 36°12′734″N, 35°51′218″E, 20–50 m, 19 June 2007, *F. Celep 1232 & G. Akgül* (holotype, GAZI; isotypes, ANK, E, K, MO). Figure 1.

Figure 1. Fertile habit of *Salvia sericeotomentosa* var. *hatayica* Celep & Doğan. Photo from the holotype *F. Celep 1232* (GAZI).

Haec varietas a *Salvia sericeotomentosa* var. *sericeotomentosa* inflorescentia dense sericeo-tomentosa et breviter glanduloso-pilosa differt.

Perennial suffruticose herb; stems ascending, erect, 20–70 cm, with a densely sericeous-tomentose and short glandular-pilose indument with sessile glands. Leaves simple, mostly basal, oblong or oblong to lanceolate, 10–60 × 6–18 mm, densely sericeous-tomentose and short glandular-pilose with sessile glands, attenuate at base, margins minutely crenulate, petiole 0.5–3 cm. Verticillasters 2- to 4-flowered, distant; bracts broadly ovate to cordate, acuminate, 5–20 × 5–20 mm, green or green to purplish green; pedicels 3–7 mm. Calyx membranous, green to purplish green, eglandular-tomentose and short glandular-pilose with sessile glands, broadly campanulate, 12–22 mm, broadening and expanding to 30 mm in fruit, upper calyx lip entire; corolla white to cream with yellow upper lip, 25–32 mm, corolla tube ca. 20–23 mm, slightly curved and widening toward throat, upper corolla lip ± straight; stamens 2, staminal connectives shorter than filaments; style white, glabrous, 20–25 mm. Nutlets globose to ovoid, dark brown to black, ca. 3–4 × 2–3.2 mm, surface slightly tuberculate.

Distribution and ecology. The two varieties are both known from Hatay Province in southern Anatolia, Turkey. Field and literature studies showed that *Salvia sericeotomentosa* var. *sericeotomentosa* was confined to open fields within *Pinus* L. forest at altitudes of 800–1000 m in its type locality in the

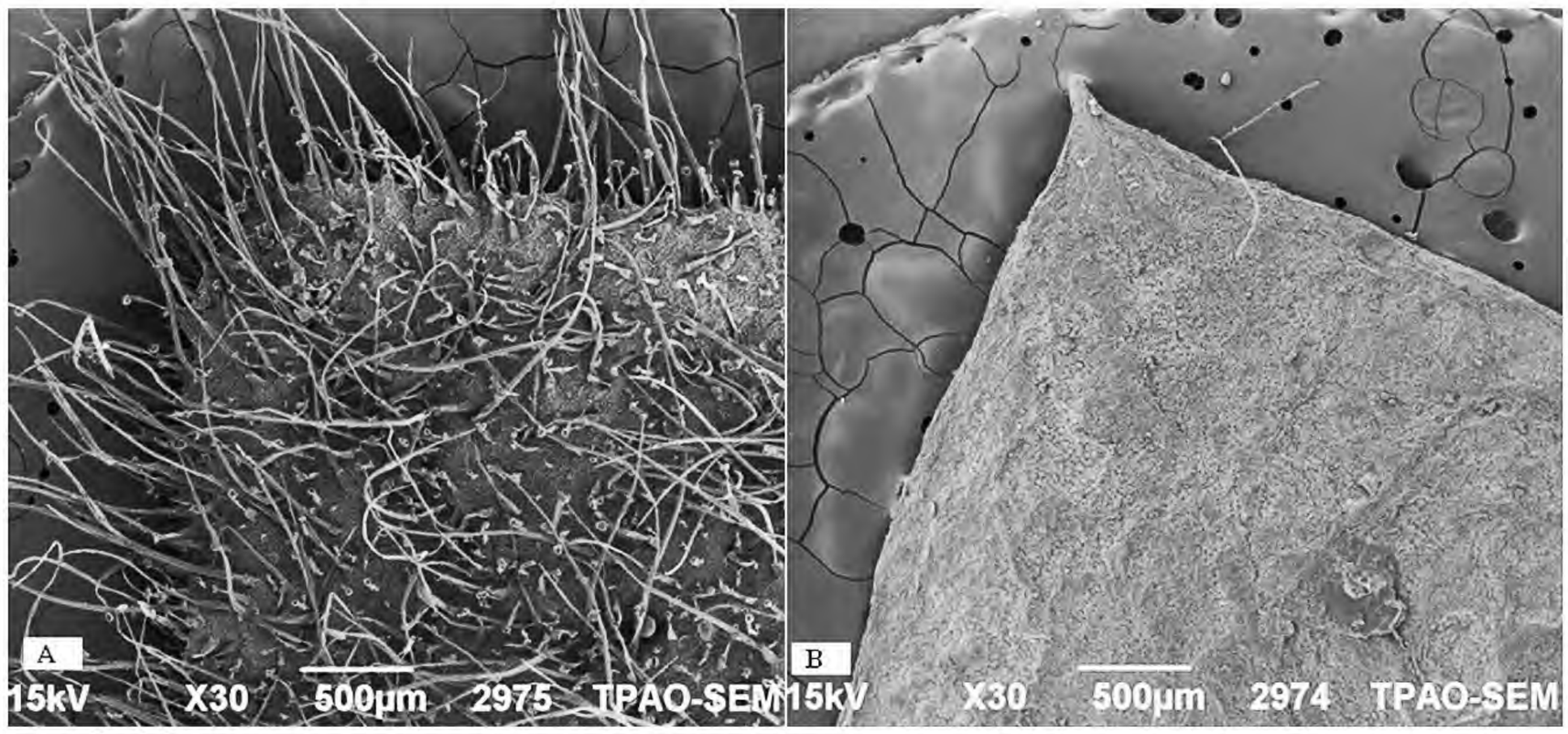

Figure 2. SEM images of calyx tips. —A. *Salvia sericeotomentosa* var. *hatayica* Celep & Doğan. —B. *Salvia sericeotomentosa* Rechinger f. var. *sericeotomentosa*. A from *F. Celep 1232* (GAZI); B from *F. Celep 1402* (ANK).

northern Amanos Mountains. The new variety and the autonymic variety have now been collected from rocky mountain slopes in association with *Quercus coccifera* L., *Pinus brutia* Tenore, *Cistus* L., *Centaurea* L., and *Pistacia* L. shrubs in the southern Amanos Mountains at lower altitudes of 20–50 m, thus extending the altitudinal range of the species from 20–1000 m.

IUCN Red List category. Despite recent expeditions, *Salvia sericeotomentosa* has not been found in its type locality. It is known only from the present localities, and its estimated area of occupancy is less than 100 km² with a population of less than 2000 individuals. According to our field observations, habitat destruction through human encroachment such as road construction, urbanization, and fire are the principal threats in the area. Therefore, the species should be considered Endangered (EN), according to IUCN Red List criteria (IUCN, 2001).

Etymology. The varietal epithet is derived from Hatay Province, the area where the new variety was first collected.

Notes. The new variety differs from the autonymic variety in its densely sericeous-tomentose and glandular-pilose inflorescences (Fig. 2, Table 1).

Paratypes. TURKEY. **Hatay:** Samandag to Arsuz, 36°12′734″N, 35°51′218″E, 25 July 2006, *S. Bagherpour & F. Celep 1197b* (ANK); Samandag to Arsuz, 36°12′736″N, 35°51′218″E, 19 June 2007, *F. Celep 1232* (ANK); Arsuz to Samandag, 36°13′393″N 35°50′711″E, 2 May 2008, *G. Akaydın & F. Celep 1403* (ANK).

Acknowledgments. We wish to thank the curators of herbaria AEF, ANK, BM, E, G, GAZI, HUB, ISTE, ISTF, K, and W for allowing us to study their *Salvia* collections and the Scientific and Technical Research Council of Turkey (TUBİTAK-TBAG-104 T 450) for their financial assistance.

Table 1. Morphological comparison of *Salvia sericeotomentosa* var. *sericeotomentos* and *S. sericeotomentosa* var. *hatayica*.

	Variety *sericeotomentosa*[1]	Variety *sericeotomentosa*[2]	Variety *hatayica*[3]
Leaf indumentum	densely sericeous-tomentose and short glandular-pilose	densely sericeous-tomentose and short glandular-pilose	densely sericeous-tomentose and short glandular-pilose
Inflorescence axis	glabrous	glabrous	densely sericeous-tomentose and short glandular-pilose
Calyx	glabrous	glabrous	sericeous-tomentose and short glandular-pilose
Corolla	—	white to cream with yellow upper lip	white to cream with yellow upper lip
Altitude (m)	800–1000	20–50	20–50

[1] Studied from the isotype *A. Eig & M. Zohary s.n.* (E).
[2] Studied from *F. Celep 1402a* (ANK).
[3] Studied from the holotype *F. Celep 1232* (GAZI).

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Taxonomic Notes on Chinese *Saussurea* (Asteraceae, Cardueae)

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Abstract. Some names in Chinese *Saussurea* DC. (Asteraceae, Cardueae) are reviewed. *Saussurea tunglingensis* F. H. Chen is accepted as the taxonomically correct name, having priority over *S. sclerolepis* Nakai & Kitagawa. *Saussurea haoi* Y. Ling ex Y. L. Chen & S. Yun Liang shares the same type with *S. bella* Y. Ling, so *S. haoi* is an illegitimate name. *Saussurea hopeiensis* F. H. Chen described from Hopei [Hebei] is subsumed as a synonym of the more widely distributed *S. mongolica* (Franchet) Franchet. *Saussurea chowana* F. H. Chen known only from its type locality in Hopei [Hebei] is treated as a synonym of the broadly distributed *S. parviflora* (Poiret) DC. *Saussurea lanatocephala* F. H. Chen known only from Jilin is synonymized to *S. triangulata* Trautvetter & C. A. Meyer. The names *S. nematolepis* Y. Ling and *S. cochleariifolia* Y. L. Chen & S. Yun Liang are lectotypified.

Key words: Asteraceae, China, Compositae, *Saussurea*.

Saussurea DC. is one of the largest genera in the tribe *Cardueae* Cassini (Asteraceae); it includes approximately 400 species (Lipschitz, 1979) and represents the largest genus of Asteraceae in China. There were 264 species recorded as native to China in *Flora Reipublicae Popularis Sinicae* (Shih & Jin, 1999).

During study of the genus *Saussurea* from China, the author found some taxonomic discrepancies. Because *Flora of China* (Asteraceae) will be published in the near future, I wish to correct these problems herein. Species with new synonymies are given in the first section, whereas notes on typifications follow.

New Synonymies

1. **Saussurea bella** Y. Ling, Contr. Inst. Bot. Natl. Acad. Peiping 6(2): 87. 1949, non *Saussurea bella* Lipschitz, 1954. *Saussurea haoi* Y. Ling ex Y. L. Chen & S. Yun Liang, Acta Phytotax. Sin. 19: 103. 1981, nom. illeg. TYPE: China. Qinghai: Tsigeganpa, Temple Tasu, 3600 m, 16 Aug. 1930, *K. S. Hao 1019* (holotype, PE; isotype, PE).

Liu (1996) treated *Saussurea haoi* as a synonym of *S. bella*, but he did not explain the reason, and he did not realize that the two taxa shared the same type. The holotype specimen of *S. bella* corresponds to the isotype for *S. haoi*, while the isotype of *S. bella* is the holotype of *S. haoi*. Accordingly, the name *S. haoi* is superfluous and therefore illegitimate by Article 52.1 of the *International Code of Botanical Nomenclature* (ICBN; McNeill et al., 2006).

2. **Saussurea mongolica** (Franchet) Franchet, Bull. Herb. Boissier 5(7): 539. 1897. Basionym: *Saussurea ussuriensis* var. *mongolica* Franchet, Nouv. Arch. Mus. Hist. Nat., sér. 2, 6: 60. 1883. TYPE: China. Hebei: Gehol [Chengde Co.], Aug. 1864, *A. David 2141* (holotype, P; isotype, LE).

Saussurea hopeiensis F. H. Chen, Bull. Fan Mem. Inst. Biol. Bot. 8: 120. 1938, syn. nov. TYPE: China. Hopei [Hebei]: Tungling, Hung-Sung-ken, July 1933, *H. F. Chow 40616* (holotype, LBG, photo, PE).

Chen (1938) regarded *Saussurea hopeiensis* as related to *S. sinuata* Komarov, but *S. hopeiensis* differs from *S. sinuata* by its larger and more scabrous leaves, numerous and smaller heads, and foliaceous bracts. Unable to see the type, Lipschitz (1979) treated *S. hopeiensis* as an uncertain species related to *S. sinuata*. *Saussurea hopeiensis* was overlooked by Shih and Jin (1999) in the *Flora Reipublicae Popularis Sinicae*. After examining the type specimens for both names, I found the name *S. hopeiensis* to represent the same taxon as the earlier name *S. mongolica*.

3. **Saussurea parviflora** (Poiret) DC., Ann. Mus. Natl. Hist. Nat. 16: 200. 1810. Basionym: *Serratula parviflora* Poiret, Encycl. (Lamarck) 6: 554. 1804. TYPE: Siberia, *Gmelin s.n.* (holotype, P not seen).

Saussurea chowana F. H. Chen, Bull. Fan Mem. Inst. Biol. Bot. 8: 119. 1938, syn. nov. TYPE: China. Hopei [Hebei]: Tungling, Wu-ling-shan, July 1933, *H. F. Chow 40867* (holotype, LBG, photo PE).

Saussurea chowana has until now only been recorded from its type locality. Chen (1938: 119) originally thought it was related to "*S. alata* Turcz." (most likely referring to *S. alata* DC.). However, *S.*

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chowana differs from *S. alata* by its smaller and undivided leaves, glabrous heads, and dark, non-recurved involucral bracts. This misled Lipschitz (1979) to place this taxon incorrectly in *Saussurea* subgen. *Theodorea* (Cassini) Lipschitz, a disposition later adopted by Shih and Jin (1999). After examining the type of *S. chowana*, I found this taxon is in fact synonymous with *S. parviflora*, which belongs to the subgenus *Saussurea* and is common in high mountains in northern China.

4. **Saussurea triangulata** Trautvetter & C. A. Meyer, Fl. Ochot. Phaenog. 58, tab. 29. 1856. TYPE: "In insula Aesae," 3 Aug. 1844, *A. Middendorff 965* (lectotype, LE, photo PE).

Saussurea lanatocephala F. H. Chen, Bull. Fan Mem. Inst. Biol. Bot. 8: 121. 1938, syn. nov. TYPE: China. Jilin: s. loc., s.d., *Coll. ignot. 1242* (holotype, designated by Chen, 1938: 121, LBG, photo PE).

Chen (1938) regarded the name *Saussurea lanatocephala* as related to *S. sinuata* and *S. sinuata* var. *cordata* F. H. Chen [= *S. hwangshanensis* Y. Ling] by its larger heads, but *S. lanatocephala* differs from both *S. sinuata* and *S. sinuata* var. *cordata* by its leaves without sinuous margins and with truncate leaf bases, and by the yellow wooly involucral bracts. After comparing the type with other species from Jilin Province, I found that *S. lanatocephala* should be reduced to the synonymy of *S. triangulata*, which occurs in Changbaishan in China, as well as in Korea and the Russian Far East.

5. **Saussurea tunglingensis** F. H. Chen, Bull. Fan Mem. Inst. Biol. Bot. 5(2): 85. 1934. TYPE: China. Hopei [Hebei]: Eastern Tomb, Feng-sung-ken, Ertou Bridge, rock cliff, s.d., *H. F. Chow 40772* (holotype, PE).

Saussurea sclerolepis Nakai & Kitagawa, Rep. Exped. Manchoukuo, Sect. IV, Pt. 1, Pl. Nov. Jehol.: 64, tab. 19. 1934, syn. nov. TYPE: China. Hebei: "in monte prope Hsing-lung," 31 Aug. 1933, *T. Nakai, Honda & Kitagawa s.n.* (holotype, TI, photo PE).

Saussurea sclerolepis f. *pinnatipartita* Nakai & Kitagawa, Rep. Exped. Manchoukuo, Sect. IV, Pt. 1, Pl. Nov. Jehol.: 65. 1934, syn. nov. TYPE: China. Liaoning: "in rupibus montis Feng-huang-shan prope Chao-yang," 9 Aug. 1933, *T. Nakai, Honda, Kitagawa s.n.* (holotype, TI not seen).

When Chen (1934) described *Saussurea tunglingensis*, he considered it related to *S. gracilis* Maximowicz, *S. saxatilis* Komarov [= *S. komaroviana* Lipschitz], and *S. umbrosa* Komarov. These taxa occur in Korea, Russia, and Japan, as well as extending into northeastern China, and are not taken here as close congeners. *Saussurea tunglingensis* occurs widely in Hebei, Nei Mongol, Liaoning, Heilongjiang, and Shanxi provinces of China.

Interestingly, the name *Saussurea tunglingensis* has never been adopted by the taxonomic community since its original publication in May 1934. Without seeing the type, Lipschitz (1979) placed the Chinese species *S. tunglingensis* close to *S. gracilis*, which occurs only in Japan, and treated this as an uncertain species. *Saussurea tunglingensis* was later overlooked by Shih and Jin (1999) in the *Flora Reipublicae Popularis Sinicae*. After examining the type of *S. tunglingensis* and comparing it to types for other *Saussurea* species from Hebei Province, I found it is conspecific with the taxon currently known as *S. sclerolepis* Nakai & Kitagawa, which was described from a very close locality in Hebei. The protologues of *S. tunglingensis* and *S. sclerolepis* were published in the same year, with the former on 1 May 1934 and the latter in November of 1934. According to Article 11.4 of the ICBN (McNeill et al., 2006), the nomenclaturally correct name should be *S. tunglingensis*.

Saussurea sclerolepis f. *pinnatipartita* Nakai & Kitagawa differs from the type for the parent species by its pinnatipartite leaves, but I have found these two kinds of forms growing together in the wild. *Saussurea sclerolepis* f. *pinnatipartita* is therefore treated as a synonym of *S. tunglingensis*.

NOTES ON TYPIFICATIONS

1. **Saussurea cochleariifolia** Y. L. Chen & S. Yun Liang, Acta. Phytotax. Sin. 19(1): 104. 1981, as "*cochlearifolia*." TYPE: China. Xizang: Yadong Co., Mangdangshan Pass, 2 Sep. 1975, *Qingzang Compl. Veg. Exped. 7690A* (lectotype, designated here, PE).

When Chen et al. (1981) published the name *Saussurea cochleariifolia* based on *Qingzang Compl. Veg. Exped. 7690* (PE), they neglected that the type specimen sheet contained two different taxa. The right-hand plant corresponds most closely with the original description and diagnosis for *S. cochleariifolia*. After careful study, this author concluded that the left-hand plant is not a *Saussurea* at all, but in fact *Youngia simulatrix* (Babcock) Babcock & Stebbins. According to Article 9. 9 and Article 9.12 of the ICBN (McNeil et al., 2006), I designate the right-hand plant on the sheet for *Qingzang Compl. Veg. Exped. 7690A* as the explicit lectotype for *S. cochleariifolia*.

2. **Saussurea nematolepis** Y. Ling, Contr. Inst. Bot. Natl. Acad. Peiping 6(2): 67. 1949. TYPE: China. Sichuan: Nanping [Jiuzhaigou Co.], 1500 m, 24 Oct. 1937, *K. T. Fu 2235* (lectotype, designated here, PE).

When Ling (1949) published this species, he cited three collections: *K. T. Fu 2235*, *K. T. Fu 7941*, and *W. Y. Hsia 7026*, without designating an unambiguous holotype. All three specimens are found in PE; *K. T. Fu 2235* is selected here as the lectotype because it is the most ample specimen.

Acknowledgments. The author thanks John Pruski and Echard von Raab-Straube for their valuable comments.

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Novae Gesneriaceae Neotropicarum XVI: *Pearcea pileifolia*, a New Species of Gesneriaceae from South America

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Abstract. A new species of Gesneriaceae (tribe Gloxinieae) is described from Ecuador and Peru in South America. *Pearcea pileifolia* J. L. Clark & L. E. Skog is vegetatively distinctive from all other species of *Pearcea* Regel by its oblong leaf blades with crenate to serrate margins and markedly anisophyllous, opposite leaves with the smaller leaf in a pair reduced to a scalelike appendage. Observations of the bivalved fruit dehiscence and the resulting appearance of winged appendages in *P. pileifolia* and other congeners are discussed.

Key words: Ecuador, Gloxinieae, IUCN Red List, *Pearcea*, Peru.

The most recent treatment of the genus *Pearcea* Regel (Gesneriaceae) is that by Kvist and Skog (1996), who recognized 17 species, including nine new species. The description of *P. pileifolia* J. L. Clark & L. E. Skog makes *Pearcea* a genus of 18 species. It is remarkable that the presently described species occurs where extensive fieldwork has been conducted and where several other species were recently described from Ecuador by Kvist and Skog (1996). Ecuador is the most diverse country for *Pearcea* with 13 species, followed by Peru with seven species. *Pearcea pileifolia* has been collected only four times: three times in Napo Province of Ecuador and once in the Cajamarca region of Peru. Napo Province of Ecuador is the most diverse region for *Pearcea* with more than half of the species (10 species of 18) evident in the genus.

The monophyly of the genus *Pearcea* is well supported by two separate molecular-based phylogenetic analyses that focused on relationships within the Gloxinieae. Roalson et al. (2005) included four species of *Pearcea* as strongly supported based on nuclear ITS data (nuclear ribosomal DNA ITS region) and chloroplast data (*trnL* intron and *trnL-trnF* intergenic spacer region). Smith et al. (2004) included two species of *Pearcea* as strongly supported based on nuclear markers (*GCYC*, which is a Gesneriaceae homolog of *CYCLOIDEA*, ITS, and two paralogues of the nuclear-encoded chloroplast-expressed glutamine synthetase) and chloroplast markers (*ndhF*, *trnL* intron, *trnL-trnF* intergenic spacer region, and *rpl20-rps12* intergenic spacer region).

Pearcea differs from related genera in the tribe Gloxinieae by the detachment of the fruit walls at the base of a dry bivalved capsule. The detachment of the fruit wall appears like a pair of winged appendages (Figs. 1G, H, 2). The fruits of all *Pearcea* initially dehisce loculicidally and then secondarily along the base of the capsule. The walls of the dry capsule remain attached to the apex of the septum. Thus, the capsule is nearly circumscissile except for the persistence of the two septa. This type of secondary dehiscence is unknown in any other genus of the Gesneriaceae.

This distinctive fruit dehiscence of *Pearcea* is illustrated in *P. pileifolia* (Fig. 1G, H). Detached fruit walls were also recently observed and photographed in many individuals and species of *Pearcea* (cf., selection of some of these images in Fig. 2). Images of the fruits exist at the Clark Lab (<http://www.bama.ua.edu/~gesner>) and in the Gesneriaceae photo library at the Smithsonian Institution's National Museum of Natural History and herbarium collections (MO, SEL, US, UNA, and elsewhere) for the following species: *Pearcea abunda* (Wiehler) L. P. Kvist & L. E. Skog (Fig. 2A), *P. hypocyrtiflora* (Hooker f.) Regel (Fig. 2B), *P. purpurea* (Poeppig) L. P. Kvist & L. E. Skog (Fig. 2C), *P. schimpfii* Mansfeld (Fig. 2D), *P. sprucei* (Britton) L. P. Kvist & L. E. Skog var. *sprucei* (Fig. 2E), and *P. sprucei* var. *parviflora* (Rusby) L. P. Kvist & L. E. Skog (Fig. 2F).

Other fruits in the Gloxinieae are capsules with two or four valves, but never with detached capsule walls at the base. The typical fruit in the Gloxinieae is a bivalved capsule, and some fruits in *Kohleria* Regel dehisce by a single longitudinal slit on the dorsal surface (Kvist & Skog, 1992; Clark & Skog, 2008). Very few observations of the fruits in *Pearcea* have been documented, and only one fruit was illustrated by Kvist and Skog (1996). The few observations of the

Figure 1. *Pearcea pileifolia* J. L. Clark & L. E. Skog. —A. Habit. —B. Indument of abaxial leaf surface. —C. Corolla. —D. Corolla opened to show stamens. —E. Calyx. —F. Calyx opened and corolla removed to show separate nectary glands. —G. Lateral view of mature fruit with calyx lobes removed. —H. Dorsal view of mature fruit showing valve walls attached to septum. —I. Seeds. A–I from the holotype, *J. L. Clark, E. Narvaez & V. Grefa 5672* (US).

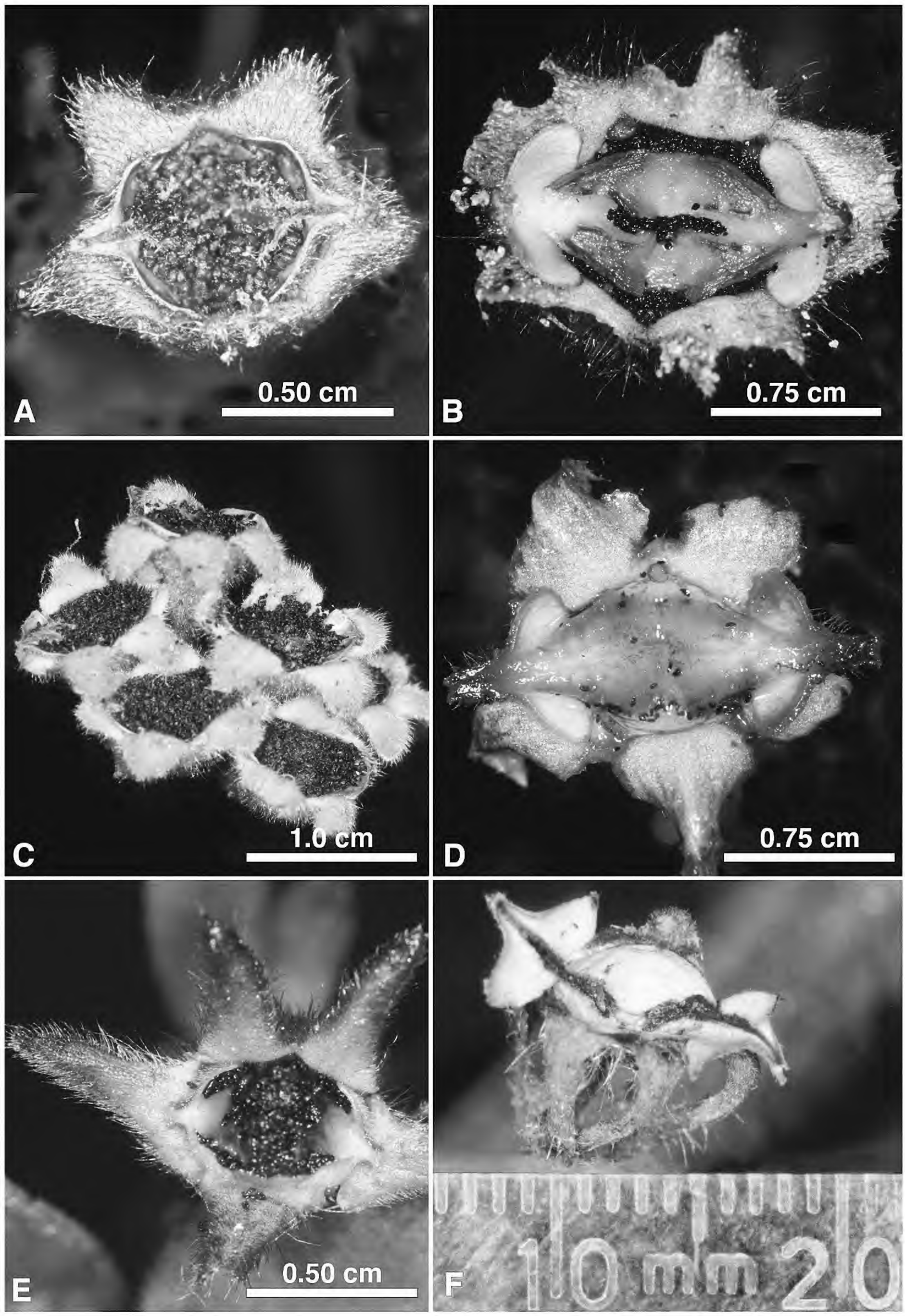

Figure 2. Variation in fruit walls found throughout *Pearcea*. —A. *P. abunda* (Wiehler) L. P. Kvist & L. E. Skog. —B. *P. hypocyrtiflora* (Hooker f.) Regel. —C. *P. purpurea* (Poeppig) L. P. Kvist & L. E. Skog. —D. *P. schimpfii* Mansfeld. —E. *P. sprucei* var. *sprucei* (Britton) L. P. Kvist & L. E. Skog. —F. *P. sprucei* var. *parviflora* (Rusby) L. P. Kvist & L. E. Skog. A from *J. L. Clark & D. Menuz, S. Quinn & M. Katan 9132*; B from *J. L. Clark & D. Menuz, S. Quinn & J. Vargas 9163*; C from *J. L. Clark, H. Beltran & I. Salinas 8184*; D from *J. L. Clark & J. Rea 8037*; E from *J. L. Clark 7062*; F from *J. L. Clark 6593*.

fruit in Kvist and Skog (1996: 7) were summarized as "... field studies showed that *Pearcea* fruits instead split from the apex all the way to the base, with two fleshy valves reflexing to expose a glutinous seed mass." We suggest that the fruits of *Pearcea* are not persistently fleshy as in many of the capsules of Episcieae, but become dry. Seeds in the capsules of *Pearcea* are exposed on reflexed valves that may at first be fleshy, but the valves persist much longer (e.g., up to weeks) instead of hours or days as in the fleshy fruits of Episcieae (e.g., *Glossoloma* Hanstein or *Drymonia* Martius).

A distinctive feature of *Pearcea pileifolia* is the change in posture from immature to mature flowers. Immature flowers of *P. pileifolia* are appressed to the abaxial leaf surface until they mature. Upon anthesis or soon thereafter, the pedicels become erect and the flowers and subsequent fruits are held above the leaves on erect pedicels. This has also been observed in two species of *Gasteranthus* Bentham (*G. leopardus* M. Freiberg and *G. wendlandianus* (Hanstein) Wiehler); the significance of the change in flower posture has not been explored, but it may facilitate pollination or seed dispersal.

Pearcea pileifolia J. L. Clark & L. E. Skog, sp. nov. TYPE: Ecuador. Napo: Cantón Cando, N of Río Jatunyacu, 01°04′45″S, 77°56′29″W, 540 m, 21 Dec. 2000 (fl., fr.), *J. L. Clark, E. Narvaez & V. Grefa 5672* (holotype, US; isotypes, AAU, BM, BRIT, CAL, COL, E, F, K, MO, NY, P, QCA, QCNE, SEL, UNA). Figure 1.

Haec species a congeneris laminis foliorum oblongis margine crenatis vel serratis et foliis valde anisophyllis paris folio minore in appendicem squamiformem reducto differt.

A terrestrial subshrub; roots fibrous, stolons and scaly rhizomes absent; stems slender, basal diam. to 3 mm, erect, 40–100 cm tall, terminally branched, subwoody at base and herbaceous at apex, terete, sparsely pilose below, densely pilose to villous above. *Leaves* opposite, unequal in a pair; larger leaf with petioles terete, 1–3 mm, green, blade membranous when dry, oblong, (2–)5–8 × 1–2 cm, base acute and occasionally asymmetrical, apex attenuate, margin crenate to serrate, adaxially pale green, sparsely pilose, abaxially uniformly green, uniformly red, or green with reddish tinge, uniformly pilose to densely pilose on veins and leaf margins; smaller leaf sessile or petiolate, petioles terete, up to 1 mm long, blade orbicular, 0.5–2 × 1–2 mm, vestiture and coloration same as larger leaf. *Inflorescence* epedunculate with solitary flowers in upper leaf axils; bracteoles absent; pedicels held below leaves when immature and becoming erect at anthesis, 2.5–3.5 cm long, densely pilose. *Floral* tube conic, 1.5–2.5 × 2–3 mm, densely pilose; calyx lobes 5, equal, erect at anthesis, persistent and reflexed in fruit, oblong-lanceolate, 3–5 × 0.5–1.5 mm wide at base, apex attenuate, margin entire, light green, outside and inside uniformly pilose; corolla 8–15 mm long, ca. 5.5 mm diam. medially, uniformly tubular with constriction at base, horizontal in calyx, outside mostly red with white base, sparsely pilose, inside mostly white with red spotting, glabrous, limb with lobes subequal, reflexed, rotund, ca. 1 × 3 mm wide at base, red, margin entire; stamens 4, didynamous, included; filaments 5–6 mm, adnate to base of corolla for 1–2 mm, glabrous; anthers longer than broad, ca. 2 × 1.5 mm, dehiscing by longitudinal slits; staminode not observed; nectary of 5 separate glands evenly distributed around ovary, glabrous, all ca. 0.25 × 0.25 mm; ovary half inferior, ca. 0.5 × 1 mm, glabrous; style and stigma not observed. *Fruit* a globose capsule, ca. 5 × 5 mm, appearing fleshy at first and then becoming dry, valves reflexed, loculicidally dehiscent, secondarily dehiscent along base with valve walls attached to septum and appearing winged; seeds numerous, subglobose, irregularly striate, ca. 0.3 × 0.3 mm, dark brown.

Distribution and habitat. *Pearcea pileifolia* is known from Ecuador on the eastern Andean slopes in Napo Province and the Cajamarca region of Peru from 540–2020 m. The forests where *P. pileifolia* occurs have been noted on the herbarium labels as being pluvial premontane, montane wet, or tropical wet. The species is not locally common, but has been observed to be abundant along streams (*J. L. Clark et al. 5672*) and a ridge (*J. L. Clark et al. 5308*). Otherwise, extensive fieldwork throughout Napo Province between 1997 and 2000 has not resulted in documenting other populations of this rare species.

IUCN Red List category. *Pearcea pileifolia* should be considered Critically Endangered (CR B2b[iv]) according to IUCN Red List criteria (IUCN, 2001). Farming and human pressures on native flora are extensive along the eastern border of the Reserva Ecológica Antisana, where one of the two Ecuadorian populations is known to exist. The population in Parque Nacional Sumaco Napo-Galeras is 40–45 km east of the Reserva Ecológica Antisana and 15–20 km east of major cities (e.g., Tena). It is likely that more fieldwork in these areas will locate additional populations of *P. pileifolia*, but so far it is considered to have a very restricted range. Although the population observed by the first author was locally abundant, it is not common along most regions of the river. It is assumed that populations are limited and that the range is severely fragmented.

Phenology. *Pearcea pileifolia* has been collected in flower in April, November, and December, and collected in fruit in December only.

Etymology. The epithet *pileifolia* is derived from the appearance of the leaves, which are reminiscent of the widespread genus *Pilea* Lindley in the Urticaceae. *Pilea* is distributed throughout the tropics and temperate regions and is one of the larger genera in the Urticales and eudicot rosids. The leaves of *Pearcea pileifolia* have crenate margins and brochidodromous venation, which are features that resemble those found in *Pilea*.

Paratypes. ECUADOR. **Napo:** Cantón Archidona, Reserva Ecológica Antisana, comunidad Shamato, entrada por Km 21–Shamato, camino Sardinas–Shamato, 00°44′S, 77°48′W, 1700 m, 28 Apr. 1998 (fl.), *J. L. Clark, E. Narvaez & P. Mamallacta 5308* (MO, QCNE, UNA, US); Cantón Archidona, Parque Nacional Sumaco Napo-Galera, Cordillera de Galeras, Bloque 19, línea 30 (Compañía Triton), 00°53′S, 77°33′W, 1400 m, 24 Apr. 1996 (fl.), *E. Freire & J. Cerda 543* (MO, QCNE, US). PERU. **Cajamarca:** San Ignacio, San José de Lourdes, 00°59′22″S, 78°53′3″W, 2020 m, 23 Nov. 1999 (fl.), *R. Vásquez & S. Flores 26324* (US).

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Melaleuca (Myrtaceae) from Australia

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Abstract. Preparation of an account of *Melaleuca* L. (Myrtaceae) for *Flora of Australia* resulted in the recognition of nine new species and three subspecies of *Melaleuca*. The following are newly described from Australia: from Queensland: *M. hemisticta* S. T. Blake ex Craven, *M. lazaridis* Craven, *M. montis-zamiae* Craven, *M. phratra* Craven, *M. pyramidalis* Craven, *M. quercina* Craven, *M. viminalis* (Solander ex Gaertner) Byrne subsp. *rhododendron* Craven, *M. williamsii* Craven subsp. *fletcheri* Craven; from New South Wales: *M. megalongensis* Craven & S. M. Douglas, *M. serpentina* Craven, *M. williamsii* subsp. *synoriensis* Craven; and from Queensland and New South Wales: *M. sabrina* Craven. The recently described *Callistemon wimmerensis* Marriott & G. W. Carr is transferred to *Melaleuca* as *M. wimmerensis* (Marriott & G. W. Carr) Craven.

Key words: Australia, IUCN Red List, *Melaleuca*, Myrtaceae, New South Wales, Queensland.

During revisionary work directed toward preparation of an account of *Melaleuca* L. and its closer allies for *Flora of Australia*, the delimitation of *Callistemon* R. Brown from *Melaleuca* was considered. The conclusion was reached that *Callistemon* was insufficiently distinct from *Melaleuca* for it to be maintained at generic rank and those species for which there was no valid name yet available in *Melaleuca* were formally transferred to that genus (Craven, 2006). Several undescribed taxa were identified in the course of the work and are newly described below. The recently described *C. wimmerensis* Marriott & G. W. Carr (Marriott & Carr, 2008) is transferred to *Melaleuca*.

The Callistemon group of *Melaleuca* is taxonomically challenging. Having studied, and considered at length, much herbarium material over the previous 10 years, supplemented with field observations, it is my belief that morphological studies alone will not permit a satisfactory taxonomy to be established. James (1958) concluded on the basis of detailed investigations into micro- and megasporogenesis that *Callistemon* contained both sexual and apomictic species. The sexual species he studied was *M. citrina* (Curtis) Dumont de Courset (as *Callistemon citrinus* (Curtis) Skeels), which is diploid with $2n = 22$ and thus typical of most other species of Myrtaceae, and the apomictic species he considered was *M. linearis* Schrader & J. C. Wendland (as the *C. rigidus–C. linearis–C. pinifolius* complex). James (1958) noted reports that indicated some populations of *M. linearis* may be diploid, and reported from his own observations $2n$ counts of 33 and 44 for this species. It seems, therefore, that a single species of this complex may contain populations that are diploid, triploid, or tetraploid. Contemporary molecular techniques permit the rapid screening of large numbers of individuals and will be of benefit in further studies of the breeding systems of this part of the genus. Detailed understanding of these breeding systems, of both the more variable and widespread (e.g., *M. citrina* and *M. pallida* (Bonpland) Craven) and the localized, relatively invariant species (e.g., *M. serpentina* Craven), is an imperative before a lasting, stable taxonomy can be achieved. The inclusion of putative hybrid entities such as *C. forresterae* Molyneux, *C. genofluvialis* Molyneux, *C. kenmorrisonii* Molyneux, and others, together with the putative parental species *M. citrina* and *M. subulata* (Cheel) Craven (utilizing the relevant local populations of the latter two species), in molecular investigations will be necessary before their biological and taxonomic status can be determined. It has been reported that at least some of the putative hybrids produce uniform progeny (Molyneux, 1994, 1997). Genetic mechanisms, perhaps apomixis, may result in stabilization of hybrids that can persist in suitable ecotones.

Taxonomic Treatment

1. **Melaleuca hemisticta** S. T. Blake ex Craven, sp. nov. TYPE: Australia. Queensland: Mt. Wheeler, SE side on trachyte cliff-lines, 7 Aug. 1993, *P. I. Forster, G. W. Wilson & R. F. Wilson 13792* (holotype, CANB; isotype, BRI not seen).

Callistemon salignus (Smith) Sweet var. *roseus* C. T. White, Proc. Roy. Soc. Queensland 55: 67. 1944, syn. nov. TYPE: Australia. Queensland: Port Curtis Distr., Forest Reserve 20, Maryvale, Yeppoon, Oct. 1924, *Richter s.n.* (holotype, BRI).

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A *Melaleuca citrina* (Curtis) Dumont de Courset ramulis sericeo-lanuginulosis, glandibus laminae foliaris in tertia parte proximali solum praesentibus vel illic numerosioribus et antheris luteis differt.

Shrub 1–6 m tall; bark papery or approaching fibrous, hard, gray; branchlets glabrescent, sericeous-lanuginulous. Leaves alternate, 42–102 × 6–28 mm, 3.5–11× as long as wide; blade sericeous to sericeous-pubescent, glabrescent, narrowly elliptic, narrowly ovate, elliptic, or rarely narrowly obovate, in transverse section transversely linear or ± oblunate, base attenuate to narrowly attenuate, apex acute or shortly acuminate, primary veins pinnate, 15 to 31 on each side of the midrib, the oil glands dense to sparse, glands distinct or obscure, often only in the proximal region or along the midrib, when distributed throughout the blade more numerous in the proximal region. Inflorescences spicate, pseudoterminal and sometimes also upper axillary or interstitial, with 10 to 50 monads, 30–45 mm wide; hypanthium glabrescent, 2.9–3.9 mm; calyx lobes abaxially hairy (usually with cilia on the margin only), 1.2–1.6 mm, scarious in a marginal band 0.4–0.5 mm wide or herbaceous to the margin; petals deciduous, 3.4–5.4 mm; stamens free, 35 to 53 per flower; filaments red or reddish pink, 16–17 mm; anthers yellow; style 17–24 mm; ovules ca. 100 to 200 per locule. Fruit 4–5.2 mm, calyx lobes deciduous; inner distal wall of staminophore without reflexed, free, antesepalous, triangular processes; seed with obvolute cotyledons.

Distribution, ecology, and phenology. In Australia, this species occurs in the Bowen-Bundaberg District and adjacent islands of Queensland. It has been recorded to occur in shrubland, rainforest margins, shrubby low open forest, the edge of riverine rainforest, *Lophostemon* Schott scrub, cliff tops, a creek bed with small boulders, a rocky hillside beside creek above mangrove, shrub community at base of rock face, windswept heathland, and on rhyolite, granite, trachyte, and brown stony soil. The species flowers from March to September.

IUCN Red List category. *Melaleuca hemisticta* can be regarded as of Least Concern (LC) according to the IUCN Red List categories and criteria (IUCN, 2001) as it is a widespread species.

Etymology. The specific epithet is derived from the Greek, "hemi-," meaning "half," and "stictos," meaning "spotted," in reference to the distribution of the oil glands within the leaf lamina.

Notes. The species is given the unpublished specific epithet coined by S. T. Blake and described as new in preference to raising *Callistemon salignus* var. *roseus* to specific rank, because the epithet *roseus* is not diagnostic for the Callistemon group. The relative distribution of leaf oil glands, i.e., being only or more numerous in the proximal third of the blade, is diagnostic for this species and the epithet *hemisticta* reflects this.

Melaleuca hemisticta resembles *M. citrina*, but *M. citrina* differs in having papery bark on the main stems (vs. fissured and hard in *M. hemisticta*), branchlet indumentum that is velutinulous or sericeous-pubescent (vs. sericeous-lanuginulous in *M. hemisticta*), uniformly distributed oil glands in the leaf blades (vs. oil glands often only in the proximal region or along midrib in *M. hemisticta*), and purple to dark reddish anthers (vs. yellow anthers in *M. hemisticta*).

Paratypes. AUSTRALIA. **Queensland:** Whitsunday Island, *C. Warrian 228* (BRI); Blackwood Natl. Park, *P. Thompson 41* (BRI); near Mangrove Beach, Shaw Island, *G. N. Batianoff & C. Dallison 3124* (BRI); 300 m S of Mt. Bertha, Gloucester Island, *G. N. Batianoff, H. A. Dillewaard & J. Lind 9403307* (AD, BRI, CANB, DNA); Shoalwater Bay (Passage 3), strait S of Townshend Island, 26 Aug. 1802, *R. Brown s.n.* (CANB, NSW); summit area of Mt. Stanley, Mt. Stanley Natl. Park, Many Peaks Range, *P. I. Forster 16273* (CANB); Ropers Peak, Peak Range, *P. I. Forster 7208* (CANB, MEL, NSW, PERTH); E slopes, Mt. Castletower Natl. Park, Many Peaks Range, *P. I. Forster 16335* (CANB); Mt. Walsh, near Biggenden, *L. A. Craven & J. A. Matarczyk 9963* (CANB).

2. Melaleuca lazaridis Craven, sp. nov. TYPE: Australia. Queensland: Rockland Springs, 34 km SSE of Blackwater township, 6 Sep. 1961, *M. Lazarides & R. Story 48* (holotype, CANB; isotypes, A, AD, ASU, BRI, DNA, MEL, PERTH).

A *Melaleuca citrina* (Curtis) Dumont de Courset cortice fibrosa, staminibus numerosioribus (48 ad 59) et antheris luteis differt.

Shrub 1–4 m tall; bark fibrous, hard; branchlets glabrescent, lanuginulous to sericeous-pubescent. Leaves alternate, 43–119 × 4.5–17 mm, 7–17× as long as wide; blade sericeous, glabrescent, narrowly elliptic, narrowly ovate, very narrowly ovate, or very narrowly elliptic, in transverse section transversely linear, sublunate, or ± oblunate, base narrowly attenuate or narrowly cuneate, apex acute, primary veins pinnate, 9 to 29 on each side of the midrib, oil glands dense or moderately dense, distinct. Inflorescences spicate, pseudoterminal or interstitial, with 25 to 60 monads, 35–60 mm wide; hypanthium glabrescent or hairy, 3.8–4.7 mm; calyx lobes abaxially hairy or glabrescent, 1.4–2 mm, scarious in a marginal band 0.4–0.9 mm wide; petals deciduous, 4.5–6.5 mm; stamens free, 48 to 59 per flower; filaments red, pink,

or mauve, 17–23 mm; anthers yellow; style 24–29 mm; ovules ca. 150 to 300 per locule. Fruit 4.5–5.7 mm, calyx lobes deciduous; inner distal wall of staminophore without reflexed, free, antesepalous, triangular processes; seed with obvolute cotyledons.

Distribution, ecology, and phenology. Within Australia, *Melaleuca lazaridis* occurs only in the Blackdown Tableland District of Queensland. Here, it has been reported to occur in open forest, on the top edge of an escarpment, along creek beds, on pale brown sandy loam, on skeletal sand over sandstone, on weathered sandstone, and on gravelly orange-brown sandy loam. The species has been collected in flower in June, August, and September.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the category Vulnerable (VU) is appropriate for *Melaleuca lazaridis*, because it is restricted to the Blackdown Tableland region of Queensland. However, because much of the Blackdown Tableland region is incorporated in a national park, its continued survival is not likely to be threatened.

Etymology. The specific epithet honors Michael Lazarides (1928–), whose collections of plants made over four decades during CSIRO's northern Australian land resources surveys have contributed significantly to our knowledge of the flora of the region.

Notes. *Melaleuca lazaridis* apparently is related to *M. citrina* and *M. hemisticta* and is distinguished from them by the following combinations of character states: *M. lazaridis*: bark of main stems fibrous, branchlet indumentum lanuginulous or sericeous-pubescent, oil glands equally distributed across the leaf blade and equally distinguishable on each surface of the leaf, inflorescence up to 60 mm wide, hypanthium sericeous, calyx lobes free, anthers yellow, and cotyledons about half as long as the embryo. The corresponding states in *M. citrina* are: bark papery, branchlet indumentum velutinulous or sericeous-pubescent, oil glands equally distributed across the leaf blade and equally distinguishable on each surface of the leaf, inflorescence up to 70 mm wide, hypanthium sericeous-pubescent, calyx lobes free or connate at the base, anthers purple to dark red, and cotyledons about one third as long as the embryo; and in *M. hemisticta*: bark fissured and hard, branchlet indumentum sericeous-lanuginulous, oil glands not equally distributed across the leaf blade (see above) and more visible on the abaxial surface of the blade than on the adaxial surface, inflorescence up to 45 mm wide, hypanthium sericeous-pubescent, calyx lobes connate at the base, anthers yellow, and cotyledons about half to one third as long as the embryo.

Paratypes. AUSTRALIA. **Queensland:** Blackdown Tableland, 3.4 km SW of Horseshoe Lookout turnoff on main rd., *B. J. Lepschi & A. V. Slee 1193* (BRI, CANB); a few hundred meters from Stony Creek Falls lookout along walking track, *L. A. Craven & J. A. Matarczyk 9990* (BRI, CANB); ca. 6 km W from Forestry camp area on Mimosa Creek, *K. A. W. Williams 74033* (BRI).

3. Melaleuca megalongensis Craven & S. M. Douglas, sp. nov. TYPE: Australia. New South Wales: just inside gate of Warri Warri Farm on Nellies Glen Rd., E edge of Megalong Valley, ca. 5 km SW of Katoomba, 3 Dec. 2002, *L. A. Craven, D. Mallinson & S. M. Douglas 10442* (holotype, CANB; isotypes, A, AD, AK, ASU, BRI, CHR, E, G, HO, K, L, MEL, MO, NE, NSW, NY, P, PRE, RSA, UC).

A *Melaleuca citrina* (Curtis) Dumont de Courset ramulis sericeis, hypanthio breviore (3.3–3.5 mm longo), staminibus brevioribus (9.5–14 mm longis) et cotyledonibus concavo-convexis differt.

Shrub to 5 m tall; bark subpapery, medium soft, flaking or peeling; branchlets glabrescent, sericeous. Leaves alternate, 35–55 × 3.5–5 mm, 8.8–12.5× as long as wide; blade sericeous, glabrescent, narrowly elliptic to narrowly obovate, in transverse section transversely linear (and usually thickened at the margin and midrib), base narrowly cuneate, apex narrowly acute to narrowly acuminate, primary veins pinnate, ca. 15 to 24 on each side of the midrib, oil glands moderately dense, distributed throughout the lamina, distinct or obscure. Inflorescences spicate, pseudoterminal, with 25 to 60 monads, 30–40 mm wide; hypanthium hairy, 3.3–3.5 mm; calyx lobes abaxially glabrescent, 1.7–2 mm, scarious in a marginal band ca. 0.5–0.7 mm wide; petals deciduous, 3.3–3.7 mm; stamens free, ca. 45 to 50 per flower; filaments magenta-pink, 9.5–14 mm; anthers dark red; style 17–19 mm; ovules numerous. Fruit ca. 6 mm, calyx lobes deciduous; inner distal wall of staminophore without reflexed, free antesepalous triangular processes; seed with concavo-convex cotyledons.

Distribution, ecology, and phenology. *Melaleuca megalongensis* is known to occur only in Megalong Valley in New South Wales, Australia. Here, it occurs on a spring-fed (and winter wet) flat with *Lomandra* Labillardière, surrounded by open eucalyptus forest with *Leptospermum* J. R. Forster & G. Forster, *Hakea* Schrader, and *Acacia* Miller growing mainly in the interzone between the flat and the forest. It flowers in November and December.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the category Vulnerable

(VU) is appropriate for *Melaleuca megalongensis* because it is restricted to Megalong Valley in New South Wales, where it occurs in small, scattered populations.

Etymology. The specific epithet is derived from the locality, Megalong Valley.

Notes. Melaleuca megalongensis is apparently closely related to *M. citrina*. The two species differ in the following features: branchlet indumentum (sericeous in *M. megalongensis* vs. velutinous or sericeous-pubescent with sparse over-topping velutinous hairs in *M. citrina*), inflorescence width (30–40 mm in *M. megalongensis* vs. 45–70 mm in *M. citrina*), hypanthium length (3.3–3.5 mm in *M. megalongensis* vs. 3.8–5.4 mm in *M. citrina*), petal length (3.3–3.7 mm in *M. megalongensis* vs. 3.9–5.8 mm in *M. citrina*), stamen length (9.5–14 mm in *M. megalongensis* vs. 17–25 mm in *M. citrina*), style length (17–19 mm in *M. megalongensis* vs. 23–31 mm in *M. citrina*), and cotyledon orientation (concavo-convex in *M. megalongensis* vs. obvolute in *M. citrina*).

4. Melaleuca montis-zamiae Craven, sp. nov. TYPE: Australia. Queensland: upstream from Freds Gorge, Mt. Zamia Environ. Park, ca. 3.5 km NW of Springsure, 16 Oct. 1993, *B. J. Lepschi & A. V. Slee 1186* (holotype, CANB; isotypes, A, BRI, L, MEL, NSW).

A *Melaleuca citrina* (Curtis) Dumont de Courset cortice fibrosa, ramulis sericeis, hypanthio breviore (3–3.4 mm longo) et antheris luteis differt.

Shrub or tree 2.5–4 m tall; bark fibrous; branchlets glabrescent, sericeous. Leaves alternate, 37–92 × 2.5–9 mm, 9.5–15× as long as wide, petiolate; blade sericeous, glabrescent, very narrowly elliptic, to narrowly ovate or narrowly elliptic, in transverse section transversely linear or sublunate, base very narrowly attenuate or narrowly cuneate, apex acute or shortly acuminate, primary veins pinnate, 18 to 27 on each side of the midrib, oil glands dense or moderately scattered, distinct. Inflorescences spicate, pseudoterminal or interstitial, with 10 to 40 monads, 30–45 mm wide; hypanthium glabrous or hairy, 3–3.4 mm; calyx lobes abaxially hairy or glabrescent, 1–1.3 mm, scarious in a marginal band ca. 0.3 mm wide or herbaceous to the margin; petals deciduous, 3.1–4.7 mm; stamens free, 40 to 58 per flower; filaments red, 14–17 mm; anthers yellow; style 12–20 mm; ovules ca. 200 per locule. Fruit 3.4–4.9 mm, calyx lobes deciduous; inner distal wall of staminophore without reflexed, free antesepalous triangular processes; seed with obvolute cotyledons.

Distribution, ecology, and phenology. In Australia, *Melaleuca montis-zamiae* occurs in the Springsure District of Queensland, where it has been collected in riparian scrub, on a cliff top, and along an ephemeral watercourse. It flowers in August and September.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the category Vulnerable (VU) is appropriate for *Melaleuca montis-zamiae*, because it is restricted to the Mt. Zamia region of Queensland. Further research is required to determine if the species occurs elsewhere in the Springsure area.

Etymology. The specific epithet is derived from the locality Mt. Zamia (from the Latin "mons," meaning "mountain," and *Zamia*, a genus of plant).

Notes. This species is distinguished from *Melaleuca citrina* in the following character states: bark texture (fibrous in *M. montis-zamiae* vs. papery in *M. citrina*), branchlet indumentum (sericeous in *M. montis-zamiae* vs. velutinous or sericeous-pubescent with sparse over-topping velutinous hairs in *M. citrina*), inflorescence rachis indumentum (sericeous or sericeous-pubescent in *M. montis-zamiae* vs. pubescent or lanuginulous-pubescent in *M. citrina*), inflorescence width (30–45 mm in *M. montis-zamiae* vs. 45–70 mm in *M. citrina*), hypanthium length (3–3.4 mm in *M. montis-zamiae* vs. 3.8–5.4 mm in *M. citrina*), anther color (yellow in *M. montis-zamiae* vs. purple to dark red in *M. citrina*), style length (12–20 mm in *M. megalongensis* vs. 23–31 mm in *M. citrina*).

Paratypes. AUSTRALIA. **Queensland:** Mt. Zamia, near Springsure, *B. O'Keefe 795* (BRI), *D. F. Blaxell & J. Armstrong 1501* (CANB, NSW), *A. R. Bean 2076* (BRI).

5. Melaleuca phratra Craven, sp. nov. TYPE: Australia. Queensland: Wilgavale, S headwaters of Little Plain Creek, 1.5 km S of State Forest 176, near Texas, 9 Jan. 1993, *P. I. Forster & D. Halford 12693* (holotype, BRI; isotype, CANB).

A *Melaleuca paludicola* Craven ramulis pubescentibus vel lanuginoso-pubescentibus, et lamina foliari trichomatibus semper sericeis et antheris luteis differt.

Shrub or tree 2–10 m tall; bark fissured, grayish brown or black; branchlets glabrescent, pubescent to lanuginous-pubescent. Leaves alternate, 22–57 × 1.2–5 mm, 10–30× as long as wide; blade sericeous, glabrescent, narrowly elliptic, in transverse section transversely linear or sublunate, base narrowly attenuate or narrowly cuneate, apex acute or shortly acuminate, primary veins pinnate, 13 to 24 on each side of the midrib, oil glands not seen. Inflorescences spicate, pseudoterminal or interstitial, with 10 to 30

Table 1. Morphological characters distinguishing *Melaleuca paludicola*, *M. phratra*, *M. quercina*, and *M. sabrina*.

Character	*M. paludicola*	*M. phratra*	*M. quercina*	*M. sabrina*
Branchlet indumentum	hispidulous or strigose	pubescent or lanuginous-pubescent	lanuginous	pubescent
Leaf blade indumentum	lanuginous or sericeous	sericeous	sericeous	pubescent to sericeous-pubescent
Calyx lobe indumentum	sericeous-pubescent	sericeous-pubescent	sericeous-pubescent	lanuginulous
Stamen length (mm)	7–11	7–11	10–14	17–24
Staminal filament color	cream, yellow, or pink	cream, yellow, or pink	cream, yellow, or pink	red
Anther color	pink	yellow	yellow	yellow
Style length (mm)	10–15	12–15	12–13	20–26
Cotyledons (times as long as the embryo)	ca. 1/2	ca. 1/3	ca. 1/2	ca. 1/3

monads, 25–30 mm wide; hypanthium hairy or glabrescent, 1.7–2.8 mm; calyx lobes abaxially hairy or glabrescent (sometimes with cilia on the margin only), 0.5–1.2 mm, herbaceous to the margin; petals deciduous, 2–3.8 mm; stamens free, 47 to 72 per flower; filaments pinkish red, pink, or creamy pale pink, 7–11 mm; anthers yellow; style 12–15 mm; ovules ca. 100 to 150 per locule. Fruit 3.1–3.7 mm, calyx lobes deciduous; inner distal wall of staminophore without reflexed, free antesepalous triangular processes; seed with obvolute cotyledons.

Distribution, ecology, and phenology. In Australia, *Melaleuca phratra* occurs in the Injune and Texas districts of Queensland, where it has been recorded as occurring in shrubland on creek banks and on limestone. The species flowers from November to February.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the category Data Deficient (DD) is appropriate for *Melaleuca phratra*, because, despite its occurrence across a relatively wide area, the size and conservation status of the several populations are unknown. It may be that the category Vulnerable (VU) would be more appropriate.

Etymology. The specific epithet refers to the group of species in southeastern Queensland and northeastern New South Wales that putatively are closely related to *Melaleuca paludicola* Craven, i.e., *M. phratra*, *M. quercina* Craven, and *M. sabrina* Craven (from the Greek, "phratra," meaning "clan" or "brotherhood").

Notes. *Melaleuca phratra*, *M. quercina*, and *M. sabrina* appear to be very closely related to *M. paludicola*, a widespread species that occurs in South Australia, Victoria, New South Wales, and the extreme south of Queensland. The four species can be distinguished by the respective combinations of character states listed in Table 1.

Paratypes. AUSTRALIA. **Queensland:** Injune, in creek at rd. crossing to Taroom, *R. D. Spencer 95* (BRI, MEL); Little Plains Creek, 25 km SE of Texas, *L. Pedley A7402* (BRI, CANB, NSW); Western Creek Forestry, W of Millmerran, Mar. 1978, *H. Horton s.n.* (BRI, NSW); jct. of Dogwood Creek & Condamine River, ca. 48 km WSW of Condamine, 18 Jan. 1970, *K. Emmerson s.n.* (BRI); Charleys Creek, Chinchilla, 16 Mar. 1963, *K. Emmerson s.n.* (BRI).

6. Melaleuca pyramidalis Craven, sp. nov. TYPE: Australia. Queensland: top of Walshs Pyramid, near Gordonvale, 29 July 1993, *P. I. Forster 13767* (holotype, BRI; isotypes, CANB, MEL, QRS).

A *Melaleuca citrina* (Curtis) Dumont de Courset glandibus laminae foliaris obscuris, hypanthio sericeo breviore (2.2–3.6 mm longo) et antheris luteis differt.

Shrub or tree 1.5–3.5 m tall; bark papery, compact, dark gray; branchlets glabrescent, sericeous or sericeous-pubescent (and then with a sparse layer of long hairs overlying a dense layer of shorter hairs). Leaves alternate, 29–84 × 8–24 mm, 3–4.5× as long as wide; blade sericeous or sericeous-pubescent, glabrescent, narrowly elliptic, narrowly obovate, or elliptic, in transverse section transversely linear, base attenuate to narrowly attenuate, apex obtusely shortly acuminate, shortly acuminate, or acute, primary veins pinnate, 15 to 28 on each side of the midrib, oil glands sparse, obscure. Inflorescences spicate, interstitial, with 20 to 50 monads, 40–60 mm wide; hypanthium hairy or rarely glabrous, 2.2–3.6 mm; calyx lobes abaxially hairy (sometimes with cilia on the margin only), 1–2.3 mm, scarious in a marginal band 0.2–0.4 mm wide or herbaceous to the margin; petals deciduous, 2.8–6.3 mm; stamens free, 35 to 42 per flower; filaments red or pink, 15–24 mm; anthers yellow; style 16–32 mm; ovules ca. 120 to 160 per locule. Fruit 3.8–5 mm, calyx lobes weathering away; inner distal wall of staminophore with reflexed, free

antesepalous ± square processes; seed with obvolute cotyledons.

Distribution, ecology, and phenology. In Australia, *Melaleuca pyramidalis* occurs in the Gordonvale–Ingham region of Queensland, where it has been recorded as growing in open forest, along a creek, on rocky slopes and hilltops, rarely in [?freshwater] mangrove swamp, on granite, and in sandy humus soil. The species has been collected in flower in July and August.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the category Vulnerable (VU) is appropriate for *Melaleuca pyramidalis*, because presently it is known from few localities and some of these are elevated sites that in the future could be subject to changed land use (e.g., building developments), whereas at present they effectively are undisturbed.

Etymology. The specific epithet is derived from the locality, Walshs Pyramid.

Notes. *Melaleuca pyramidalis* putatively is closely related to *M. citrina*, and the two species can be distinguished by the following character states: leaf oil glands (obscure in *M. pyramidalis* vs. distinctly visible in *M. citrina*), hypanthium indumentum (sericeous in *M. pyramidalis* vs. sericeous-pubescent in *M. citrina*), hypanthium length (2.2–3.6 mm in *M. pyramidalis* vs. 3.8–5.4 in *M. citrina*), anther color (yellow in *M. pyramidalis* vs. purple to dark red in *M. citrina*), and cotyledon length (ca. 1/2 as long as the embryo in *M. pyramidalis* vs. ca. 1/3 as long as the embryo in *M. citrina*).

Paratypes. AUSTRALIA. **Queensland:** summit of Walshs Pyramid, *H. Flecker s.n. NQNC 5056* (BRI, QRS); ca. 16 km N of Ingham, *R. Smith 1* (BRI); Hinchinbrook Island, NE slope of Mt. Diamantina, *S. T. Blake 18858* (BRI).

7. Melaleuca quercina Craven, sp. nov. TYPE: Australia. Queensland: Oakey Creek on W side of Brookvale Park Rd., 10 km W of Oakey, 7 Mar. 1991, *M. E. Ballingall 2720* (holotype, CANB; isotypes, A, BRI, L).

A *Melaleuca paludicola* Craven ramulis lanuginosis et antheris luteis differt.

Tree 6–10 m tall; bark corky, dark; branchlets glabrescent, lanuginous. Leaves alternate, 23–74 × 3.5–12 mm, 4.7–9× as long as wide; blade sericeous, glabrescent, narrowly elliptic or elliptic, in transverse section transversely linear, sublunate, or obsublunate, base narrowly attenuate, apex shortly acuminate or acute, primary veins pinnate, 11 to 20 on each side of the midrib. Inflorescences spicate, interstitial or pseudoterminal, with 15 to 40 monads, 25–30 mm wide; hypanthium glabrescent or glabrous, 2.5–3.2 mm; calyx lobes abaxially hairy (sometimes with cilia on the margin only), 1–1.3 mm, herbaceous to the margin; petals deciduous, 3.1–4.4 mm; stamens free, 70 to 94 per flower; filaments pink, cream, or pale yellow, 10–14 mm; anthers yellow; style 12–13 mm; ovules ca. 110 to 150 per locule. Fruit 3–5.3 mm, calyx lobes deciduous; inner distal wall of staminophore without reflexed, free antesepalous triangular processes; seed with obvolute cotyledons.

Distribution, ecology, and phenology. *Melaleuca quercina* occurs in the Dalby–Oakey District of Queensland, Australia. There, it grows along the flats and banks of creeks and rivers, on blackish brown clay. It has been collected in flower in October, December, and February.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the category Data Deficient (DD) is applicable to *Melaleuca quercina*. Presently it is known only from the Oakey Creek and Clifton areas of Queensland, and both of these are in agricultural country. With further field investigations, the category Near Threatened (NT) may be more appropriate.

Etymology. The specific epithet is derived from *Quercus* L. (oak) in reference to the locality Oakey Creek. It is noted that the term "oak" in Australia commonly, but not exclusively, is applied to plants of the genus *Casuarina* L. (In the common names of *Casuarina* species, the term apparently is to be spelled "-oke" as in buloke.)

Notes. The differences between this species and its putative relatives, *Melaleuca paludicola*, *M. phratra*, and *M. sabrina*, are given in Table 1.

Paratypes. AUSTRALIA. **Queensland:** Oakey Creek crossing on rd. to Brookvale Park, ca. 7 km W of Oakey, *B. J. Lepschi & A. V. Slee 1330* (BRI, CANB); Oakey Creek, near Brookvale Park, also where rd. from Jondaryan crosses Oakey Creek, *P. F. Lumley 1132* (CANB, MEL); Aides Bridge, Kings Creek, 4 km W of Clifton, *B. J. Lepschi & A. V. Slee 1332* (BRI, CANB).

8. Melaleuca sabrina Craven, sp. nov. TYPE: Australia. Queensland: Severn River, where crossed 8 km W of Fletcher by rd. W from New England Hwy., S of Stanthorpe, 19 Nov. 1983, *P. F. Lumley 1118* (holotype, MEL; isotypes, BRI, CANB).

A *Melaleuca paludicola* Craven lamina foliari pubescente vel sericeo-pubescente, lobis calycinis lanuginulosis, staminibus longioribus (17–24 mm longis) filamentis rubris antheris luteis et stylo longiore differt.

Shrub or tree 1–4 m tall; bark fibrous; branchlets glabrescent, pubescent. Leaves alternate, 10–59 × 1–3.5 mm, 8–27× as long as wide; blade pubescent to sericeous-pubescent, glabrescent, narrowly elliptic, narrowly obovate, linear-elliptic, or linear-obovate, in transverse section transversely linear, sublunate, or suboblunate, base narrowly attenuate, narrowly cuneate, or parallel (blade width equals petiole width), apex shortly acuminate or acute, primary veins pinnate, 9 to 17 on each side of the midrib. Inflorescences spicate, interstitial or pseudoterminal, with 5 to 25 monads, 30–50 mm wide; hypanthium hairy, 2.6–3.5 mm; calyx lobes abaxially hairy, 1–1.9 mm, herbaceous to the margin or scarious in a marginal band 0.2–0.3 mm wide; petals deciduous, 3.2–5.3 mm; stamens free, 49 to 73 per flower; filaments red, 17–24 mm; anthers yellow; style 20–26 mm; ovules ca. 100 to 200 per locule. Fruit 3.5–3.8 mm, calyx lobes deciduous; inner distal wall of staminophore without reflexed, free antesepalous triangular processes; seed with obvolute cotyledons.

Distribution, ecology, and phenology. *Melaleuca sabrina* occurs in Australia in the Stanthorpe District of Queensland and the Tenterfield District of New South Wales. The species has been recorded as occurring on a floodplain in granite sand among boulders, and on alluvial stream banks. It flowers from October to January and in March.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the category Data Deficient (DD) is applicable to *Melaleuca sabrina.* The species does occur in agricultural country, but the present pattern of land use is unlikely to lead to severe degradation of its riverine habitat to the extent that its continued survival is of concern. However, with further field investigations the category Near Threatened (NT) or Vulnerable (VU) may be more appropriate.

Etymology. The specific epithet refers to the Latin name of the river nymph, Sabrina, who according to Celtic mythology was believed to dwell in, and be one with, the Severn River in the United Kingdom. It seems appropriate to me that this riverine species of *Melaleuca* is given an epithet so strongly associated with the river that presumably prompted the naming of the Australian stream.

Notes. *Melaleuca sabrina* is an attractive plant in flower. In its morphology it seems to be very closely related to *M. paludicola*, but it is strikingly distinct in its longer stamens with red filaments. The differences between the two species are given in Table 1.

Paratypes. AUSTRALIA. **Queensland:** Granite Creek betw. Warwick & Stanthorpe, Oct. 1967, *W. T. Jones s.n.* (CANB); Pikes Crossing, Goldfields, Stanthorpe, 9 Mar. 1968, *G. Trapnell s.n.* (BRI, CANB); Coochy Creek, Coochy Station on Warwick–Stanthorpe Rd., 9 Mar. 1968, *G. Trapnell s.n.* (BRI). **New South Wales:** on the side of a small creek, ca. 16 km past the Summit Border Gate, on rd. to Maryvale, *J. C. Morrow 45* (BRI); Maryland River crossing on the Wylie Creek Rd., *P. G. Wilson & R. Rowe 1310* (CANB, NSW).

9. Melaleuca serpentina Craven, sp. nov. TYPE: Australia. New South Wales: 2.8 km along Crow Mountain Rd. from Woodsreef, E of Barraba, 31 Oct. 1997, *L. A. Craven & J. A. Matarczyk 10023* (holotype, CANB; isotypes, A, AD, ASU, BRI, G, L, MEL, MO, NE, NSW, P, RSA).

A *Melaleuca citrina* (Curtis) Dumont de Courset filamentis staminalibus pallidis (luteis vel cremeoviridibus), antheris luteis, et stylo breviore (11–18 mm longo) differt.

Shrub 2.5–4 m tall; bark hard and papery, flaking; branchlets glabrescent, sericeous. Leaves alternate, 21–53 × 2–5 mm, 7.5–15× as long as wide; blade sericeous to pubescent, glabrescent, linear-obovate, narrowly obovate, or narrowly elliptic, in transverse section suboblunate or transversely linear, base narrowly cuneate, apex acute or shortly acuminate, primary veins longitudinal-pinnate, oil glands moderately dense or dense, distinct. Inflorescences spicate, pseudoterminal and sometimes also upper axillary, with 15 to 35 monads, 30–40 mm wide; hypanthium hairy, 3–4 mm; calyx lobes abaxially hairy or glabrescent, 0.9–1.8 mm, scarious in a marginal band 0.4–0.7 mm wide; petals deciduous, 2.2–4 mm; stamens free, 37 to 51 per flower; filaments yellow or cream-green, 9–17 mm; anthers yellow; style 11–18 mm; ovules ca. 200 to 300 per locule. Fruit 4.2–4.6 mm, calyx lobes abaxially deciduous; inner distal wall of staminophore without reflexed, free antesepalous triangular processes; seed with obvolute cotyledons.

Distribution, ecology, and phenology. This species occurs in Australia in the Barraba District of New South Wales. Here, it grows in grassy, gully woodlands on serpentine soils. *Melaleuca serpentina* has been collected in flower in April, October, and December.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the category Vulnerable (VU) is applicable to *Melaleuca serpentina*, as its populations are believed to be small and there is a possibility that pasture improvement or renewed mining-associated activities could seriously reduce the size of, or even eliminate, some of its populations.

Etymology. The specific epithet refers to the apparent restriction of this plant to serpentine soils.

Notes. *Melaleuca serpentina* putatively is closely related to *M. citrina*, and the two species may be distinguished by the following character states: branchlet indumentum (sericeous in *M. serpentina* vs. velutinulous or sericeous-pubescent in *M. citrina*), orientation of primary veins relative to the midrib (longitudinal-pinnate in *M. serpentina* vs. pinnate in *M. citrina*), length of staminal filaments (9–17 mm in *M. serpentina* vs. 17–25 mm in *M. citrina*), color of staminal filaments (yellow or cream-green in *M. serpentina* vs. red or mauve in *M. citrina*), anther color (yellow in *M. serpentina* vs. purple to dark red in *M. citrina*), and style length (11–18 mm in *M. serpentina* vs. 23–31 mm in *M. citrina*).

Paratypes. AUSTRALIA. **New South Wales:** 1 km S of Woodsreef mine tailings, *J. R. Hosking 494* (CANB, NE); gully below King Solomons Mine, W of Woodsreef, *J. R., T. L. & G. R. Hosking 1580* (CANB); 8 km S of Upper Bingara, alongside Upper Bingara Rd., *J. R. Hosking 1621* (CANB); Ironbark Creek, Barraba, Sep. 1929, *H. M. Rupp s.n.* (NSW).

10. Melaleuca viminalis (Solander ex Gaertner) Byrnes, Austrobaileya 2: 75. 1984. Basionym: *Metrosideros viminalis* Solander ex Gaertner, Fruct. Sem. Pl. 1: 171, t. 34, fig. 4. 1788. *Callistemon viminalis* (Solander ex Gaertner) G. Don, in Loudon, Hort. Brit. 197. 1830. TYPE: Australia. Queensland: Endeavour River, s.d., *J. Banks & D. Solander s.n.* (holotype, BM).

10a. Melaleuca viminalis subsp. **viminalis**.

10b. Melaleuca viminalis subsp. **rhododendron** Craven, subsp. nov. TYPE: Australia. Queensland: Mt. Hutton, W of Injune, early Oct. 1996, *Stanford s.n.* (holotype, CANB; isotypes, A, BRI, L, MEL, MO, NSW).

A *Melaleuca viminali* (Solander ex Gaertner) Byrnes subsp. *viminali* habitu arboris unicaulis usque ad 35 m altae et hypanthio breviore (1.8–2.8 mm longo) differt.

Tree to 35 m tall, single-stemmed; bark hard, persistent; branchlets glabrescent, long pubescent. Leaves alternate, 25–60 × 2–6 mm, 8–12× as long as wide; blade pubescent, glabrescent, narrowly elliptic, in transverse section transversely linear, base attenuate, apex acuminate to narrowly acute, primary veins pinnate, numerous, oil glands moderately dense. Inflorescence spicate, pseudoterminal or with a leafy axis distal to the inflorescence, with 10 to 30 monads, 30–47 mm wide; hypanthium hairy, 1.8–2.8 mm; calyx lobes abaxially hairy, 1.1–1.8 mm, scarious in a narrow marginal band 0.3–0.8 mm wide; petals deciduous, 4–5 mm; stamens connate proximally into 5 bundles and falling as a single unit, 9 to 12 per bundle, red, 12–21 mm, the bundle claw 1.1–2 mm, 0.05–0.07× as long as the filaments; anthers purple to maroon; style 15–21 mm; ovules ca. 100 to 125 per locule. Fruit 3–5.4 mm, calyx lobes weathering away; seed not seen.

Distribution and ecology. This subspecies occurs in the Injune District of Queensland, Australia. The only population known occurs along a creek bank in basalt soil.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the category Vulnerable (VU) is applicable to *Melaleuca viminalis* subsp. *rhododendron*, as it is known from a single population of unknown size. Further field investigations are needed to determine if any other populations or subpopulations exist.

Etymology. The subspecific epithet is a compound noun in apposition derived from the Greek "rhodon," meaning "rose" or "rose-colored," and "dendron," meaning "tree," in reference to the staminal filament color and habit of the plant.

Note. This species is distinguished from the more common, multi-stemmed form of *Melaleuca viminalis* on the basis of its habit. Forming a single-stemmed, large tree, it is a remarkable plant, and it is speculated that this may represent an ancestral morph of the species, i.e., the common, multi-stemmed rheophyte, *M. viminalis* subsp. *viminalis*. It is anticipated that this plant may be useful as a tree for urban parks and street plantings in suitable climates, and its potential as a plantation tree for timber needs consideration also.

Paratype. AUSTRALIA. **Queensland:** Mt. Hutton, W of Injune, *J. Larmour 2170* (CANB).

11. Melaleuca williamsii Craven, Novon 16: 474. 2006. Replaced name: *Callistemon pungens* Lumley & R. D. Spencer, Muelleria 7: 253, f. 1. 1990. TYPE: Australia. New South Wales: ca. 0.3 km along rd. to Armidale from jct. with rd. from Armidale–Dorrigo Rd. to Hillgrove (ca. 4 km from hwy.), 21 Nov. 1983, *P. F. Lumley 1150* (holotype, MEL; isotypes, CANB, K not seen, NE, NSW not seen).

11a. Melaleuca williamsii subsp. **williamsii.**

11b. Melaleuca williamsii subsp. **fletcheri** Craven, subsp. nov. TYPE: Australia. Queensland: Broadwater Creek, where crossed by rd. from The Summit, 5 km beyond turnoff to Jollys Falls, ca. 10 km N of Stanthorpe, 19 Nov. 1983, *P. F. Lumley 1120* (holotype, MEL; isotypes, BRI, CANB).

Table 2. Morphological characters distinguishing *Melaleuca williamsii* subsp. *williamsii*, *M. williamsii* subsp. *fletcheri*, and *M. williamsii* subsp. *synoriensis*.

Character	subsp. *williamsii*	subsp. *fletcheri*	subsp. *synoriensis*
Bark texture	papery	fibrous	—
Leaf blade indumentum	lanuginulous	sericeous	sericeous or velutinous
Hypanthium indumentum	sericeous	sericeous	sericeous-pubescent
Staminal filament color	red or purple	white, pink, or mauve	pink, red, or purple
Cotyledons (appearance in transverse section)	obvolute	plano-convex or concavo-convex	concavo-convex

A *Melaleuca williamsii* Craven subsp. *williamsii* cortice fibrosa, lamina foliari sericea, filamentis albis roseis vel malvinis et cotyledonibus planoconvexis vel concavoconvexis differt.

Shrub to 4 m tall; bark flaking or persistent, fibrous, hard; branchlets hairy to glabrous, sericeous with some longer spreading or spreading-ascending, sericeous-pubescent hairs, or lanuginous with some spreading-ascending or ascending sericeous-pubescent hairs, or pubescent with spreading hairs of variable lengths. Leaves alternate, 20–68 × 4–14 mm, 3.1–8.8× as long as wide; blade sericeous or glabrous, occasionally with a few spreading-ascending or ascending hairs, narrowly obovate, narrowly elliptic, elliptic, or obovate, in transverse section transversely linear or sublunate, base narrowly attenuate or narrowly cuneate, apex shortly acuminate, acuminate, or acute, primary veins pinnate or longitudinal-pinnate, when pinnate 8 to 14 on each side of the midrib, oil glands dense or moderately dense, distinct. Inflorescences spicate, pseudoterminal, with 15 to 45 monads, 30–45 mm wide; hypanthium hairy or glabrescent, 3.1–4.3 mm; calyx lobes abaxially hairy or glabrescent, 1.6–2.1 mm, scarious in a marginal band 0.8–0.9 mm wide or scarious throughout; petals deciduous, 2.1–5.8 mm, margin ciliate; oil glands circular or subcircular; stamens free, 35 to 48 per flower; filaments white or mauve-pink, 9–19 mm; anthers purple or maroon; style 13–23 mm; ovules ca. 100 to 150 per locule. Fruit 4.4–6.6 mm, calyx lobes deciduous; inner distal wall of staminophore without reflexed, free antesepalous triangular processes; seed with plano-convex or concavo-convex cotyledons.

Distribution, ecology, and phenology. *Melaleuca williamsii* subsp. *fletcheri* occurs in the Stanthorpe District of Queensland, Australia. It has been recorded as growing in riparian woodland/shrubland and in crevices of small granite outcrops, and as flowering in November.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the category Vulnerable (VU) is applicable to this plant, as it is known only from the Stanthorpe region of Queensland. As with *Melaleuca sabrina*, *M. williamsii* subsp. *fletcheri* does occur in agricultural country, but the present pattern of land use is unlikely to lead to severe degradation of its habitat to the extent that its continued survival is of concern. However, further field investigations are required.

Etymology. This taxon is named in honor of Mervyn P. Fletcher (1901–1982), who collected many interesting and unusual plants in the Ballandean District, including *Homoranthus montanus* Craven & S. R. Jones. Fletcher lived from 1950 until his death in his 1948 Commer Utility, mainly on the banks of the Severn River, and was an advocate in the Stanthorpe District for the conservation of nature.

Notes. The differences between this taxon and subspecies *williamsii* and *synoriensis* are given in Table 2.

Paratypes. AUSTRALIA. **Queensland:** Happy Valley, roadside on Stanthorpe–Amiens Rd. ca. 3 km from Stanthorpe, *K. A. W. Williams 75163* (BRI); Glen Alpin, ca. 6 km SW of Stanthorpe, 29 Dec. 1967, *G. Trapnell s.n.* (BRI); Jollys Falls, 1.6 km W of The Summit, 8 km N of Stanthorpe, *D. Hoskings s.n.* (BRI); Severn River crossing, Fletcher Rd., near jct. with Emu Swamp Rd., Fletcher, *P. Grimshaw 441* (BRI); rd. crossing of Severn River, 2.9 km along Bent Rd. from Ballandean township, *L. A. Craven & J. A. Matarczyk 9950* (BRI, CANB); Ballandean, 6 Nov. 1976, *M. P. Fletcher s.n.* (BRI).

11c. Melaleuca williamsii subsp. **synoriensis** Craven, subsp. nov. TYPE: Australia. New South Wales: ca. 200 m NE of Toms Cabin, NE part of New England Natl. Park, ca. 12 km SE of Ebor, 4 Dec. 1993, *B. J. Lepschi & J. Mowatt 1411* (holotype, CANB; isotypes, BRI, MEL, NE, NSW).

A *Melaleuca williamsii* Craven subsp. *williamsii* lamina foliari sericea vel velutina et cotyledonibus concavoconvexis differt.

Shrub to 3.5 m tall; bark flaking or peeling away; branchlets hairy or glabrous, pubescent. Leaves alternate, 18–51 × 4–9 mm, 4.2–7.8× as long as wide; blade sericeous to velutinous or glabrous, narrowly elliptic, elliptic, or narrowly obovate, in

transverse section transversely linear or shallowly bird-winged, base narrowly attenuate or attenuate, apex shortly acuminate or acute, primary veins pinnate, 9 to 12 on each side of the midrib, oil glands dense or moderately dense, distinct. Inflorescences spicate, pseudoterminal and sometimes additional inflorescences occur in distal leaf axils, with 10 to 40 monads, 25–30 mm wide; hypanthium hairy or glabrescent, 3.2–4 mm; calyx lobes abaxially hairy or glabrescent, 1–1.8 mm, scarious throughout; petals deciduous, 3–3.8 mm; stamens free or rarely some are fused to one another at the very base, 50 to 66 per flower; filaments red or pink-purple, 6.5–11 mm; anthers dark; style 12–15 mm; ovules ca. 200 per locule. Fruit 3.9–5.2 mm, calyx lobes deciduous; inner distal wall of staminophore without reflexed, free antesepalous triangular processes; seed with concavo-convex cotyledons.

Distribution, ecology, and phenology. This taxon occurs in the Gibraltar Range–Point Lookout District of New South Wales, Australia. It has been recorded to occur in scrub and heath on extensive trachyte outcrops, in a creek bed in dry sclerophyll forest, and on wet heathy flats on granite. *Melaleuca williamsii* subsp. *synoriensis* flowers in November and December.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the category Vulnerable (VU) is applicable to this plant, as it is known only from the Gibraltar Range–Point Lookout District of New South Wales. As with many similarly localized species, further field investigations are required to assess population size and other factors.

Etymology. The subspecific epithet refers to the distribution of this taxon on the edge of the Northern Tablelands (from the Greek "synoria," meaning "borderland").

Notes. The differences between this taxon and subspecies *williamsii* and *fletcheri* are given in Table 2.

Paratypes. AUSTRALIA. **New South Wales:** Gibraltar Range Natl. Park, 4 km past Ranger's Hut on Gwydir Hwy. toward Grafton, near Waratah Trig, *P. F. Lumley 1142* (CANB, MEL); 1.6 km WSW of Point Lookout, New England Natl. Park, 8 Feb. 1970, *J. B. Williams s.n.* (NE).

12. Melaleuca wimmerensis (Marriott & G. W. Carr) Craven, comb. nov. Basionym: *Callistemon wimmerensis* Marriott & G. W. Carr, Muelleria 26: 57–63. 2008. TYPE: Australia. Victoria: Wimmera, Wonwondah East, ca. 18 km S of Horsham on W bank of MacKenzie River, 142°12′1″E, 36°54′29″S, 28 Sep. 2004, *G. W. Carr & V. Stajsic 0411-343* (holotype, MEL not seen; isotypes, AD, BRI, CANB, HO, K, MELU, NE, NSW, NY all not seen).

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Quassia arnhemensis, a New Species of Simaroubaceae from Australia

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ABSTRACT. *Quassia arnhemensis* Craven & Dunlop is described and illustrated from the Northern Territory, Australia. Within the Simaroubaceae, this new species is considered best placed in *Quassia* L., necessitating an expanded circumscription of that genus to accommodate plants with eligulate staminal filaments.

Key words: Australia, IUCN Red List, *Quassia*, Simaroubaceae.

Among the many fire-adapted subshrubs and shrubs occurring in the savannah woodland and open forest communities of the Top End of the Northern Territory of Australia, there are several species that are noteworthy due to their taxonomic distinctiveness, e.g., *Arnhemia cryptantha* Airy Shaw (Thymelaeaceae), *Gossypium* L. sect. *Grandicalyx* (Fryxell) Fryxell (Malvaceae), and *Pachynema* R. Brown ex DC. spp. (Dilleniaceae). These species share the following characteristics: aerial stems that rarely grow to as much as 1 m in height, aerial stems that are burnt by the frequent fires (and consequently these stems are, in effect, annual or biennial), and rootstocks that survive fire and from which new shoots arise. To their number may now be added a species of *Quassia* L. (Simaroubaceae). It is likely that the species is relictual, although its adaptations to survive the fire regimes may represent more recent evolutionary innovations. One of the populations of the present species was found on a residual (ancient) lateritic Tertiary plateau, one of a number scattered across northern Australia.

The generic placement of the Australian species requires comment. Nooteboom (1962) circumscribed *Quassia* broadly with 19 other genera included in it, among them *Samadera* Gaertner and *Simaba* Aublet. Nooteboom recognized both *Samadera* and *Simaba* at sectional rank and placed the two then-named Australian species in section *Simaba* (Aublet) Pierre, making the new combinations *Q. bidwillii* (Hooker f.) Nooteboom and *Q. baileyana* (Oliver) Nooteboom. Such a broad generic circumscription, although it may well be justified, requires further investigation. The available molecular evidence is not sufficiently comprehensive to enable comparison with Nooteboom's concept of *Quassia*. Fernando et al. (1995) included *Quassia*, *Simarouba* Aublet, and *Q. bidwillii* (as *Simaba bidwillii* (Hooker f.) Feuillet) in a molecular systematic study of Simaroubaceae using *rbcL* sequence data. In their analysis, *Quassia* sensu Nooteboom is not monophyletic, with two sister Australian species forming a clade, and *Simarouba* and *Quassia* s. str. each in separate clades within a five-branched polytomy (Fernando et al., 1995: fig. 3). The subject of the present paper, *Q. arnhemensis* Craven & Dunlop, was included by Fernando et al. (1995: 97, as "Species novum (ined.)") in their study. They found that the species formed a clade with the Australian species, *Q. bidwillii*. Until a more comprehensive molecular systematic study of Simaroubeae (Richard ex Arnott) Dumortier, incorporating many more of the generic concepts taken into *Quassia* by Nooteboom (1962), is undertaken, we believe the present species is best placed in *Quassia*, the circumscription of which should be emended to include plants with eligulate staminal filaments.

Quassia arnhemensis Craven & Dunlop, sp. nov. TYPE: Australia. Northern Territory: western Arnhem Land, Kakadu Natl. Park, near Mary River Ranger Station on track to Ferny Pool, 24 Apr. 1990, *A. V. Slee & L. A. Craven 9825* (holotype, CANB; isotypes, A, DNA, L). Figure 1.

A *Quassia bidwillii* (Hooker f.) Nooteboom foliis linearibus 1–1.5 mm latis (10–20 mm in *Q. bidwillii*), petalis albis (rubroviridibus in *Q. bidwillii*) et staminibus longioribus (3–3.5 mm longis in floribus perfectis; 1.5–2 mm in *Q. bidwillii*) differt.

Shrub, erect, several-stemmed, 0.2–0.4 m tall; trichomes simple, multicellular, uniseriate, mostly glandular; bark of tap root manifestly corky; stems

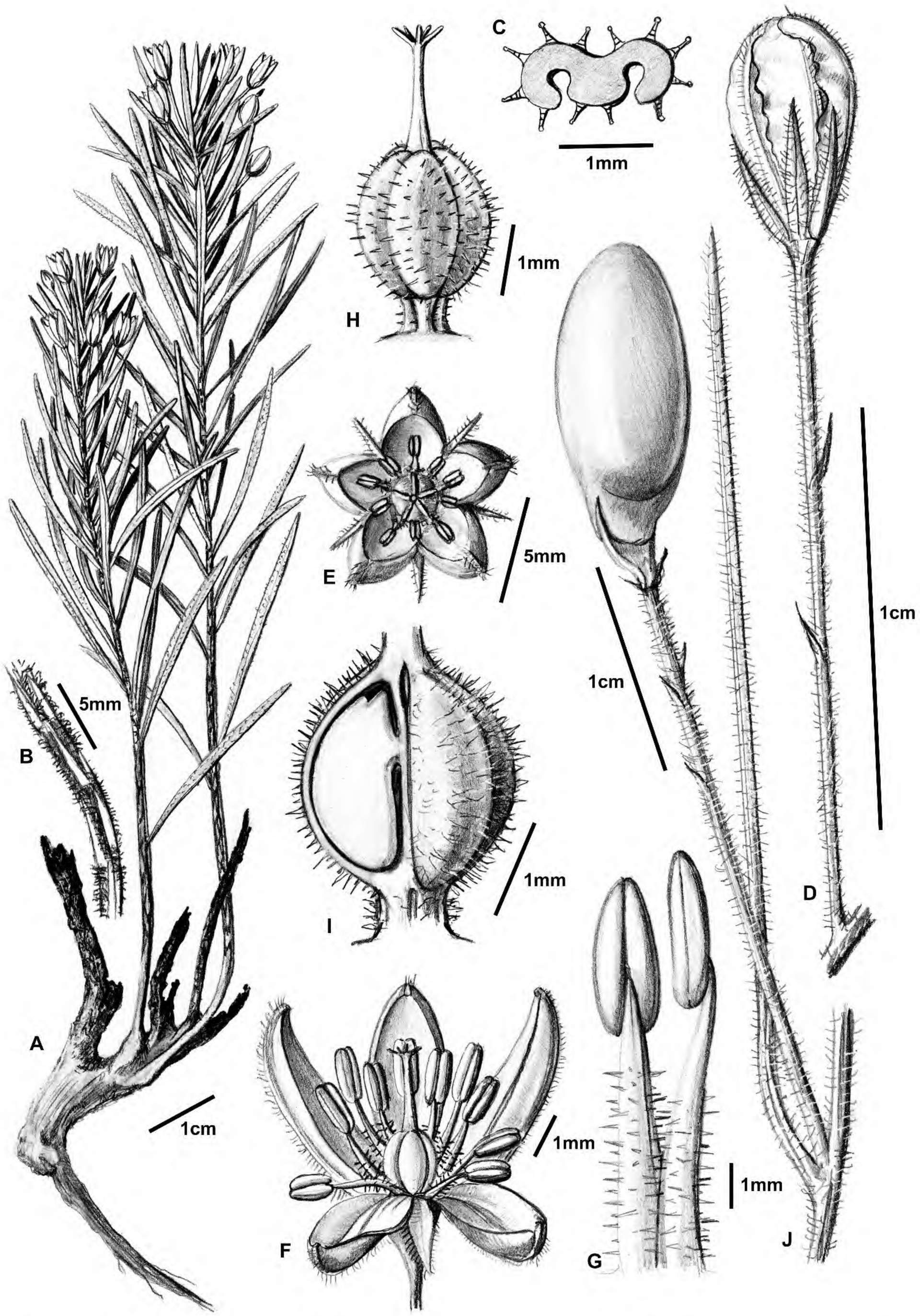

Figure 1. *Quassia arnhemensis* Craven & Dunlop. —A. Flowering branch. —B. Portion of branchlet. —C. Leaf blade cross section. —D. Flower bud. —E. Flower, carpellate, viewed from above. —F. Flower, staminate. —G. Anthers. —H. Gynoecium. —I. Ovary with carpel wall cut away to show ovule. —J. Fruit. Drawn from *Dunlop & Wilson 8893* (DNA).

bitter, corky, like the leaves; pedicels, sepals, and disc hispidulous. Leaves alternate, simple; petiole 0.6–1 mm; blade linear, revolute, 20–50 × 1–1.5 mm, midrib prominent abaxially, impressed adaxially, otherwise venation invisible. Pedicels 7–15 mm, with 1 or 2 linear, caducous bracts 0.5–1.5 mm; flowers functionally unisexual, solitary, axillary. Sepals 5, distinct, valvate, lanceolate, 1.5–3.5 mm, deciduous in fruit; petals 5, white, distinct, imbricate, spreading-ascending, keeled, glabrous except for the hispidulous keel, elliptic, 5–7.5 mm, deciduous in fruit; stamens 10, distinct, 3–3.5 mm (in carpellate flowers 2.5–3 mm), filament hispidulous in proximal 1/2–2/3, eligulate (i.e., without a basal appendage), sublinear, filiform at apex, anther ellipsoid, 1–1.3 mm (in carpellate flowers collapsed, without pollen, 0.7–0.8 mm), dorsifixed, versatile, latrorse; disc intrastaminal, broadly columnar, ca. 0.5 × 0.5 mm, accrescent to ca. 2.5 × 2 mm in fruit; gynoecium 5-carpellate, 2.5–3 mm (in staminate flowers 1.5–2 mm), carpels hispidulous or sparsely so, subreniform, joined apically in the style, otherwise distinct, the placentation axile, near the apex, ovules 1 per carpel (in staminate flowers abortive), pendulous, epitropous ventral, anatropous, style straight, glabrous or nearly so, ca. 1.5 mm, 5-sulcate, 5-branched distally, branches terete, linear, recurved, ca. 0.25 mm, stigmatic in distal 1/2. Fruit a 1-seeded, 1-carpellate drupe (4 of the 5 carpels abortive and usually deciduous) subtended by the accrescent fleshy disc, ellipsoid-reniform, 12–14 mm, inconspicuously constricted into a 2-lobed broadly stipitate base, epicarp fleshy, reddish orange, sparsely hispidulous, endocarp thickly cartilaginous; seed ellipsoid, ca. 7.5 mm; testa pergamentaceous; endosperm lacking; embryo straight, cotyledons plano-convex, elliptic in outline, hypocotyl short, exserted.

Distribution, ecology, and phenology. The new species occurs in Australia in the western Arnhem Land region of the Northern Territory. It has been collected in *Eucalyptus tetrodonta* F. Mueller woodland on red sandy loam with some gravel, *Eucalyptus miniata* A. Cunningham ex Schauer–*E. tetrodonta* F. Mueller–*Erythrophleum* Afzelius ex G. Don forest on red-brown sandy loam below sandstone outcrop, *Eucalyptus tetrodonta* open forest on laterite, and in sandstone woodland. The taxon flowers from April to December.

IUCN Red List category. *Quassia arnhemensis* can be regarded as Vulnerable (VU) according to IUCN Red List categories and criteria (IUCN, 2001), as it apparently occurs in localized populations. However, the known populations are within a national park and, because a change in the pattern of current land use is unlikely, the status of this species is not considered threatened.

Etymology. The specific epithet is derived from the name of the region, Arnhem Land, from which the type was collected.

Breeding system. Field observations are required to clarify whether plants are dioecious or monoecious. The available herbarium specimens are not adequate to determine this fact conclusively.

Phytochemistry. Gibbons et al. (1997: 1109, as "aff. *Samadera* SAC-2825") reported on the secondary metabolites found in this species. *Quassia arnhemensis* is unusual in the Rutales, as it contains limonin, which had hitherto been unique to the Rutaceae. The secondary metabolite 2′-acetylglaucarubin had previously been known only from one other species in the Simaroubaceae. Gibbons et al. (1997: 1110) suggested that this unusual chemistry could have existed in early members of Rutales prior to the metabolic differentiation that now exists between the Meliaceae, Rutaceae, and Simaroubaceae.

Paratypes. AUSTRALIA. **Northern Territory:** on rd. to Jabiru, 70 km NE of Pine Creek, *T. & J. Whaite 3989* (DNA; NSW not seen); near Mary River Ranger Station, *I. D. Cowie & C. R. Dunlop 1454* (CANB, DNA); ca. 3 km ESE of Mary River Ranger Station, *A. V. Slee, L. A. Craven, C. R. Dunlop & P. Munns 2800* (A, BRI, CANB, DNA, E, L); 1 km NE of Bloomfield Spring, 30 km SE of Mary River Station, *T. Orr & K. Brennan 336* (CANB, DNA; AD, BRI, G, K, L, MEL, MO, NSW, NY, P, PERTH not seen); 1 km N of small waterhole, 30 km W of Sleisbeck on Buladeno Tableland, *K. Brennan & T. Orr 337* (CANB, DNA); Kakadu Natl. Park, Bukbukluk, *J. Russell-Smith & R. Harwood 10492* (CANB, DNA; BRI not seen); Kakadu Natl. Park, *C. R. Dunlop & C. G. Wilson 8893* (DNA).

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A New Species of *Viola* (Violaceae) from Guangdong, China

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Abstract. A new species of *Viola* L. from Guangdong Province, China, *V. guangzhouensis* A. Q. Dong, J. S. Zhou & F. W. Xing, is described and illustrated here. The new taxon represents a fifth species in *Viola* sect. *Diffusae* (W. Becker) Ching J. Wang, and a taxonomic key to distinguish these taxa in China is included. *Viola guangzhouensis* is distinct from the sympatric *V. diffusa* Gingins by having obviously aerial stems, brownish purple stolons, and a bearded anterior petal. The new species is a narrow endemic, collected only from Dalingshan in Guangzhou, Guangdong Province, and is assessed as Critically Endangered (CR).

Key words: China, Guangdong, IUCN Red List, section *Diffusae*, *Viola*, Violaceae.

During fieldwork in March 2007 for the investigation of the flora in the mountainous region of Dalingshan in Guangdong Province, China, we found a distinctive population of violets along a forest margin at altitudes of 710–750 m. Individuals were found growing in watery rocky crevices and bearing both flowers and fruits. The purplish flowers were very conspicuous against the rock surfaces. This violet is similar to *Viola diffusa* Gingins in having a slightly 2-lobed stigma, long stolons with rosulate leaves at the apex, purplish flowers, a short corolla spur, and pubescent leaf blades. The new species differs in its obviously aerial stems, brownish purple stolons, the more narrowly triangular, cordate, acute leaves, and the bearded anterior petal. After careful study, we believe that this represents an undescribed species in *Viola* L.

Viola guangzhouensis A. Q. Dong, J. S. Zhou & F. W. Xing, sp. nov. TYPE: China. Guangdong: Guangzhou city, Conghua Co., Dalingshan, watery rocky crevices along forest margin, 710 m, 2 Apr. 2007, *An-qiang Dong 1104* (holotype, IBSC). Figure 1.

Haec species *Violae diffusae* Gingins affinis, sed ab ea caulibus aeriis manifestis 5–25 cm longis, stolonibus fusco-purpureis, foliis ovato-triangulatis vel anguste triangulatis atque petalo antico barbato differt.

Perennial herb to 10–30 cm tall, caulescent; rhizome usually obliquely ascending, 1–1.5 mm diam., brownish purple, short, stout, nodes congested, with numerous white adventitious rootlets; stems solitary or several and fasciculate, erect, slender, glabrous, 5–25 cm, 0.8–2 mm diam., leafy; stolons with an apical rosette of leaves, usually producing adventitious roots. Basal leaves numerous, rosulate, petiole 1–3 cm; blades narrowly ovate to ovate, 1–2 × 0.5–1 cm, base cordate, apex acute, margins obtusely dentate, both surfaces white puberulent, usually withering early; cauline leaves few, petiole 1.5–4 cm, conspicuously winged, usually white puberu-

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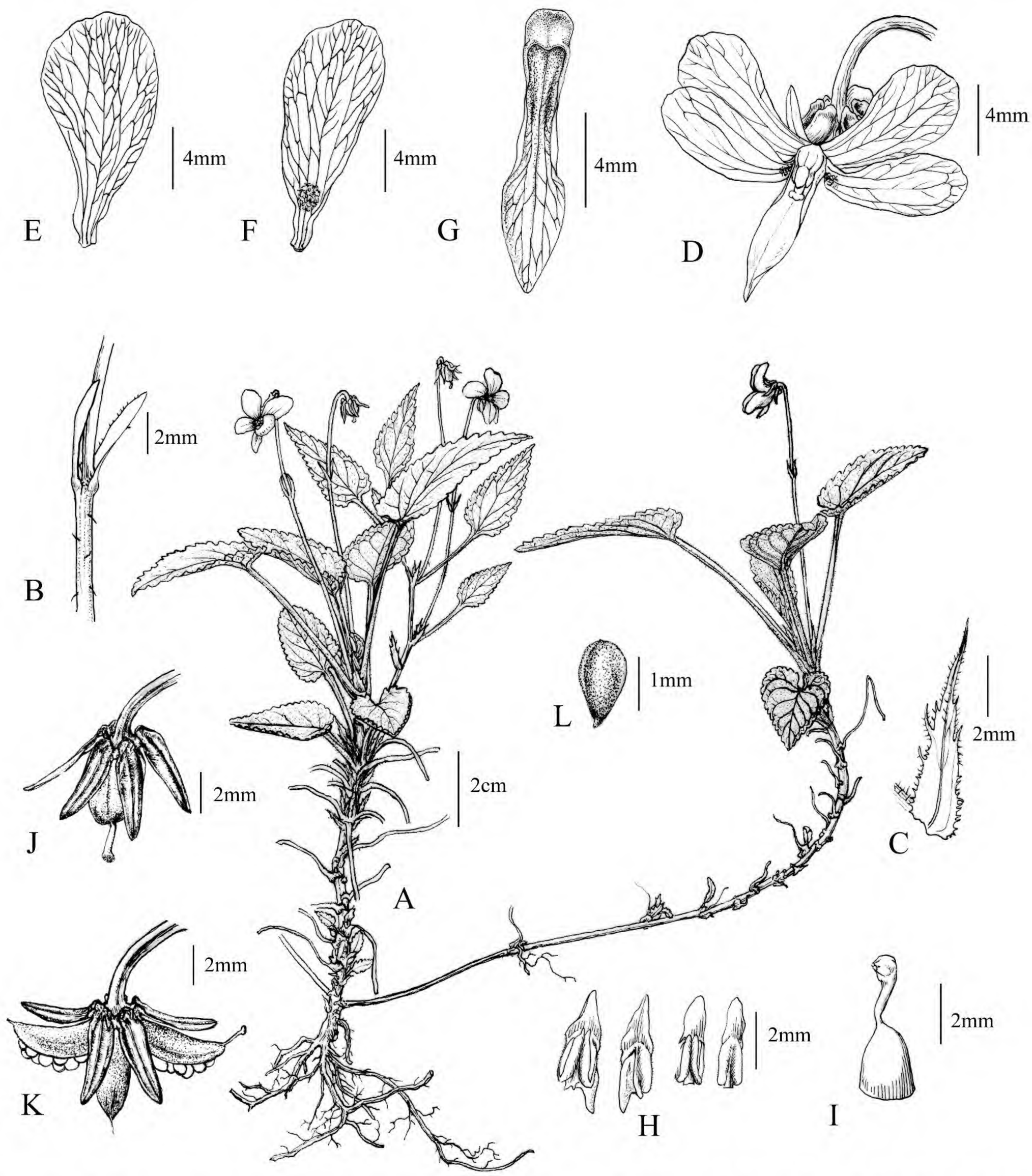

Figure 1. *Viola guangzhouensis* A. Q. Dong, J. S. Zhou & F. W. Xing. —A. Habit. —B. Bracteole. —C. Stipule. —D. Flower in front view. —E. Upper petal. —F. Lateral petal. —G. Anterior petal. —H. Stamens. —I. Pistil. —J. Capsule. —K. Exposed capsule. —L. Seed. A–I from the holotype *An-qiang Dong 1104* (IBSC); J–L from the paratype *An-qiang Dong 2257* (IBSC).

lent, blades ovate-triangular to narrowly triangular, 2–5 × 0.8–2 cm, base cordate, apex acute, margins obtusely dentate and ciliate, both surfaces densely white puberulent when young, later glabrescent between veins, but densely puberulent along veins and margins; stipules linear-lanceolate, 6–8 mm, margins remotely denticulate or fimbriate-dentate, apex acuminate, cauline stipules free, basal stipules adnate 1/3 to petiole bases. Flowers solitary in axils of cauline leaves, white to purplish white, with purple striations, 15–18 mm diam.; pedicels 6–10 cm, usually exceeding leaves, slender; 2-bracteolate at upper portion, bracteoles opposite, linear, 5–7 mm. Sepals lanceolate to ovate-lanceolate, 5–6 × 1.5–1.8 mm, apex acuminate, basal auricles short, margin narrowly membranous; upper petals narrowly obovate, 12–14 × ca. 7 mm, lateral petals oblong, 11–13 × ca. 5 mm, bearded, anterior petal shorter, spatulate, ca. 12 mm (spur included), bearded; spur shallowly saccate, 1.3–1.5 × ca. 1.5 mm; stamens 5, 3–4.2 × ca. 1.5 mm, nectaries of 2 anterior stamens short, subtriangular, ca. 1.5 × 0.8 mm; ovary glabrous; styles clavate, base

Table 1. Morphological comparison of *Viola guangzhouensis* and *V. diffusa*.

Characters	*V. guangzhouensis*	*V. diffusa*
Flower	lateral and anterior petals bearded	lateral petals glabrous or shortly bearded, anterior petal glabrous
Leaf blade	ovate-triangular to narrowly triangular, base cordate, apex acute	ovate or ovate-oblong, cuneate or shallowly cordate, apex obtuse
Stolon	brownish purple, nodes dense and with remains of stipules	slender, green
Aerial stem	solitary or several, fasciculate, erect, slender, glabrous, 5–25 cm long	absent

geniculate, 2.2–2.6 mm, gradually thickened at upper portion; stigmas thickly margined on lateral sides, slightly raised at central part, shortly beaked at the apex. Capsule ellipsoid, glabrous, 5–6 mm diam., glabrous; seeds ovoid, ca. 1.5 × 1 mm, glabrous.

Distribution and habitat. *Viola guangzhouensis* is a narrow endemic of southern China, found only in the type locality, Dalingshan, Guangzhou city, Guangdong Province, China. It is not common there, and is mostly found growing in watery rocky crevices.

IUCN Red List category. During the investigation, the first author found fewer than 20 populations, encompassing about 350 individuals in an area of approximately 1000 m^2. According to IUCN Red List categories and criteria (IUCN, 2001), this species should be categorized as Critically Endangered (CR). Fortunately, the type locality has been established as an exceptionally well-preserved forest park since 1995.

Phenology. *Viola guangzhouensis* was observed in flower from March to May.

Discussion. *Viola* is the largest genus in the family Violaceae, with 525 to 600 species in the world (Clausen, 1964; Ballard et al., 1999). Becker (1925) divided the genus *Viola* into 14 sections; the most complicated of these, section *Viola* L., includes 17 subsections. *Viola guangzhouensis* is a member of section *Diffusae* (W. Becker) Ching J. Wang, which was formerly treated as subsection *Diffusae* under section *Viola* L. by Becker (1925), based on its slightly 2-lobed stigma and stolons topped by rosettes of leaves, but is distinguished by its evident, aerial stems. This section is comprised of about four species that are distributed in southern and southeastern Asia (Becker, 1925; Wang, 1991), and one new taxa was added recently (Zhou et al., 2008). Five species are currently accepted in section *Diffusae* and are presented in a key below. *Viola diffusa*, which is quite common in the type locality of *V. guangzhouensis*, is the closest relative of *V. guangzhouensis*. The two species have similar purplish flowers, accumbent stolons, and leaf petioles with conspicuous wings, but *V. guangzhouensis* is distinguished by its obviously vertical aerial stems and bearded anterior petal. The morphological characters of the two species are compared in Table 1.

KEY TO THE SPECIES OF *VIOLA* SECT. *DIFFUSAE* IN CHINA

1a. Plant with aerial stems . . . . . *V. guangzhouensis*
1b. Plant lacking stems.
  2a. Flowers 30–35 mm across . . . . . *V. nanlingensis* J. S. Zhou & F. W. Xing
  2b. Flowers < 20 mm across.
    3a. Flowers < 15 mm across.
      4a. Leaves cuneate or shallowly cordate at base; lateral petals usually bearded . . . . . *V. diffusa*
      4b. Leaves cordate at base; lateral petals usually beardless . . . . . *V. tenuis* Bentham
    3b. Flowers 15–20 mm across.
      5a. Leaves ovate; lateral petals beardless . . . . . *V. nagasawae* Makino & Hayata var. *nagasawae*
      5b. Leaves triangular-ovate; lateral petals bearded . . . . . *V. nagasawae* var. *pricei* (W. Becker) J. C. Wang & T. C. Huang

Paratypes. CHINA. **Guangdong:** Guangzhou city, Conghua Co., Dalingshan, watery rocky crevices along forest margin, 750 m, 27 Apr. 2007, *An-qiang Dong 1130* (IBSC); 750 m, 29 May 2007, *An-qiang Dong 1157* (IBSC), *An-qiang Dong 2257* (IBSC).

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Stylosanthes quintanarooensis (Leguminosae, Papilionoideae), Una Nueva Especie del Sureste de México

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Resumen. Una nueva especie, *Stylosanthes quintanarooensis* Gama & Dávila (Leguminosae, tribu Dalbergieae, dentro del clado *Pterocarpus*), del estado de Quintana Roo (sureste de México), se describe e ilustra. Se presentan datos sobre su hábitat y distribución geográfica. Con base en caracteres morfológicos y moleculares, esta especie se compara con *S. calcicola* Small, *S. macrocarpa* S. F. Blake y *S. mexicana* Taubert, las cuales se consideran como las especies más relacionadas.

Abstract. A new species from the state of Quintana Roo (southeastern Mexico), *Stylosanthes quintanarooensis* Gama & Dávila (Leguminosae, tribe Dalbergieae, within a *Pterocarpus* clade), is described and illustrated. Data are presented on the habitat and geographical distribution of the new species. Based on morphological and molecular data, the new species is compared to its most closely related taxa, *S. calcicola* Small, *S. macrocarpa* S. F. Blake, and *S. mexicana* Taubert.

Key words: Mexico, Quintana Roo, *Stylosanthes*.

Como parte del proyecto de investigación sobre la diversidad genética del género *Stylosanthes* Swartz (Leguminosae, tribu Dalbergieae, clado *Pterocarpus*) para México, apoyado por el Instituto Internacional de Recursos Fitogenéticos (IPGRI), se visitaron y colectaron en la República Mexicana diferentes poblaciones de *Stylosanthes*. Durante los años 1998 y 1999, se llevó a cabo el trabajo de campo en el sureste de México, en la Península de Yucatán. El material colectado en el Municipio de Felipe Carrillo Puerto, en el estado de Quintana Roo, fue inicialmente identificado como *Stylosanthes* aff. *calcicola* y relacionado morfológicamente con las especies de *S. calcicola* Small, *S. macrocarpa* S. F. Blake y *S. mexicana* Taubert (Cuadro 1). Sin embargo, con los estudios morfológicos y moleculares de estos ejemplares y de aquellos depositados en el Herbario Nacional de México (MEXU) se sustenta la existencia de una especie nueva, la cual se describe a continuación.

Stylosanthes quintanarooensis Gama & Dávila, sp. nov. TIPO: México. Quintana Roo: Mpio. Felipe Carrillo Puerto, Km 25 del entronque a Vigía Chico, carr. Cancún–Chetumal, 1 ene. 1998, *S. Gama-López 254, con Salvador Arias y Jorge Sánchez-Ken* (holotipo, MEXU; isotipos, ENCB, IZTA, MO) [GenBank AJ416023, chloroplast partial tRNA-Leu (UAA) gene; AJ416311, rRNA gene, ITS1 and ITS2; AJ416716, shst2 gene 3′UTR; AJ416726, STS shst1]. Figura 1.

Herba perennis vel frutex 40–60 cm altus; caules ramosi, erecti vel erecto-prostrati, non viscidi. Stipulae secus caulem persistentes, 8–11 × 1–4 mm, bidentatae, dentibus quam basi stipularum brevioribus vel eam aequantibus; folia trifoliolata, foliolis lanceolatis vel ellipticis, coriaceis. Inflorescentiae paniculatae, longiores quam latiores, pedunculis 1 vel 2(vel 3) per bracteam, (5–)10–30(–55) mm; bractea extima 1- vel 3-foliolata; axis rudimentarius absens; bracteola externa 1, internae 2(vel 3). Calyx 5–6.5(–7) × 7–8 mm; corolla lutea, vexillo 8.5–10 × 9–9.5 mm. Fructus generaliter ex articulis fertilibus 2 constans, superiore 4.5–5 × 1.5–2 mm, in partibus marginalibus lateralibusque hirsutulo, sine trichomatibus glandularibus, rostro recto vel recurvato, inferiore 3–3.5 × 2–3 mm, in paginis totis hirsutulo; fructus basis latior quam longior.

Hierbas perennes o arbustos, tallos ramificados, erectos a erecto-postrados, (20–)40–60(–80) cm alto, indumento seríceo-hirsútulo, ocasionalmente estrigoso, no víscido, el seríceo 0.1–0.5 mm, el hirsútulo 0.6–1 mm, blanco o amarillo pálido, se distribuye por un lado del tallo, el estrigoso cuando presente, 1–2 mm, amarillo pálido a pardo-amarillento, se distribuye en la base de las estípulas, entrenudos (0.5–) 1–4.5 mm. Estípulas persistentes a lo largo del tallo,

Cuadro 1. Comparación morfológica entre *Stylosanthes quintanarooensis*, *S. calcicola*, *S. macrocarpa* y *S. mexicana*.

	S. quintanarooensis	*S. calcicola*	*S. macrocarpa*	*S. mexicana*
Hábito	hierbas perennes o arbustos	herbáceo	herbáceo	herbáceo
Persistencia de estípulas a lo largo del tallo	si	no	no	no
Consistencia de los folíolos	coriáceos	no coriáceos	no coriáceos	no coriáceos
Dimensiones del estandarte, mm	8.5–10 × 9–9.5	4–6	3.5–5.5	2.5–6
Eje rudimentario	no	si	si	si

8–11 × 2–4 mm, superficie adaxial glabra, superficie abaxial con indumento seríceo de color blanco o amarillo pálido a pardo-amarillento, bidentadas; dientes más cortos o iguales que la base de las estípulas, 3.5–4.5 mm, ápice abruptamente acuminado, margen generalmente entero; región basal de la estípula 5–6.5 mm, de 2 ó 3(4) pares de venas; zona de abscisión entre el pecíolo y la región basal de la estípula (0.3–)0.5–1 mm. Hojas trifolioladas; pecíolos (1.5–)2–3.5 mm, con indumento seríceo-hirsútulo; raquis 0.9–1.5 mm, con indumento seríceo-hirsútulo; folíolo central 12–15.5(–16) × 2–4.5(–5) mm; folíolos laterales 10.5–14.5(–15) × 2.3–3.5 mm, lanceolados a elípticos, ápice mucronado, margen entero-crenado, coriáceos, superficie adaxial con indumento seríceo, superficie abaxial con indumento seríceo-estrigoso, el estrigoso se distribuye sobre la vena central, máculas presentes de color pardo-rojizo, venas conspicuas de 3 ó 4 pares. Inflorescencias paniculadas, más largas que anchas, 10–15(–18) × 5–10 mm, 4 a 6(8) flores; pedúnculos 1 ó 2(3) por bráctea, (5–)10–30(–55) mm largo, con indumento seríceo-hirsútulo-estrigoso, el seríceo se distribuye a lo largo del pedúnculo, el hirsútulo se acumula a un lado del pedúnculo, el estrigoso se dispone en la base de la bráctea más externa. Bráctea más externa unió trifoliolada, cuando unifoliolada 7–10 × 4–6 mm, bidentada; dientes ligeramente igual de largos que la base, 3.5–5 mm, base 4.4–5.5(–6) mm, ápice acuminado, margen crenado, superficie adaxial glabra, superficie abaxial con indumento seríceo-estrigoso, amarillo a pardo-amarillento, 2 ó 3(4) pares de venas; cuando trifoliolada, el folíolo central 8–11 × (1.8–)2–4 mm, los folíolos laterales 7–11 × 1.8–3.5 mm, folíolos elíptico-lanceolados, ápice mucronado, coriáceos, superficie adaxial con indumento seríceo, superficie abaxial generalmente con indumento seríceo o seríceo-estrigoso, el estrigoso principalmente en la vena central, máculas presentes o ausentes, pardo-rojizas, venas conspicuas (1)2 a 4 pares, margen entero-crenado; eje rudimentario ausente; bractéola externa 1, 4.5–5.5 × 0.8–1.3 mm, lóbulos 2 a 4, venas 1 ó 2(4), brácteolas internas 2(3), 4–5 × ca. 0.5 mm, lóbulo 1, vena 1. Flores papilionadas, cáliz 5–6.5(–7) × 7–8 mm, tubo del cáliz 10.5–14 mm, lóbulos laterales 2, 4.5–5 × 1.1–1.8 mm, ápice acuminado o agudo, glabro o con indumento en ambas superficies; lóbulos vexilares 4.5–5.5 × 2–2.5 mm, ápice acuminado o agudo, glabro o con indumento en ambas superficies, lóbulo carinal 5–6.5 × 2–2.5 mm, ápice acuminado o agudo, con indumento generalmente en ambas superficies; corola amarilla, estandarte 8.5–10 × 9–9.5 mm; alas 6.5–8.5 × 3.5–4.5 mm, aurícula del ala 0.6–0.8 × 0.7–0.75 mm; quilla 8–10 × (0.75–)1.50–2.25 mm; tubo estaminal 11–14.5 mm, filamentos de anteras basifijas 5.5–6.5 mm, filamentos de anteras dorsifijas 6.5–8 mm; ovario 1.5–2.5 mm, estilo 10.5–15.5 mm. Frutos generalmente con 2 artículos fértiles; el superior 4.5–5 × 1.5–2 mm, hírtulo en las regiones marginales y laterales, sin tricomas glandulares, venas conspicuas, 1 dorsal, 1 lateral, las secundarias reticuladas, el rostro recto o recurvado, hírtulo a hirsútulo en el margen interno; el inferior 3–3.5 × 2–3 mm, hírtulo generalmente en toda la superficie, la base del fruto más ancha que larga.

Hábitat y distribución. *Stylosanthes quintanarooensis* se conoce únicamente del sureste de México, en la costa de Quintana Roo; habita en el bosque subcaducifolio, en lugares con suelo arenoso y crece en un intervalo altitudinal de 0–10 m.

Fenología. Respecto a la época de floración, existen también diferencias entre *Stylosanthes quintanarooensis* y las otras especies mencionadas. En *S. quintanarooensis* la floración es de diciembre a febrero. En contraste, en *S. calcicola* la floración se presenta de noviembre a enero, en *S. macrocarpa* de octubre a diciembre y en *S. mexicana* de agosto a octubre.

Discusión. De acuerdo a los resultados obtenidos en este trabajo y en los estudios moleculares previos (Vander Stappen et al., 2002; Gama-López et al., 2007), esta especie está relacionada con *Stylosanthes calcicola*, *S. macrocarpa* y *S. mexicana*. Todas son plantas sufrutescentes, tienen dos bractéolas internas, el fruto posee dos regiones fértiles, y el rostro es recto a recurvado en el ápice. Sin embargo, *S. quintanarooensis* es diferente de ellas por ser arbustiva, tener estípulas persistentes en la base del tallo y en las ramas secundarias, tener folíolos coriáceos, estandarte

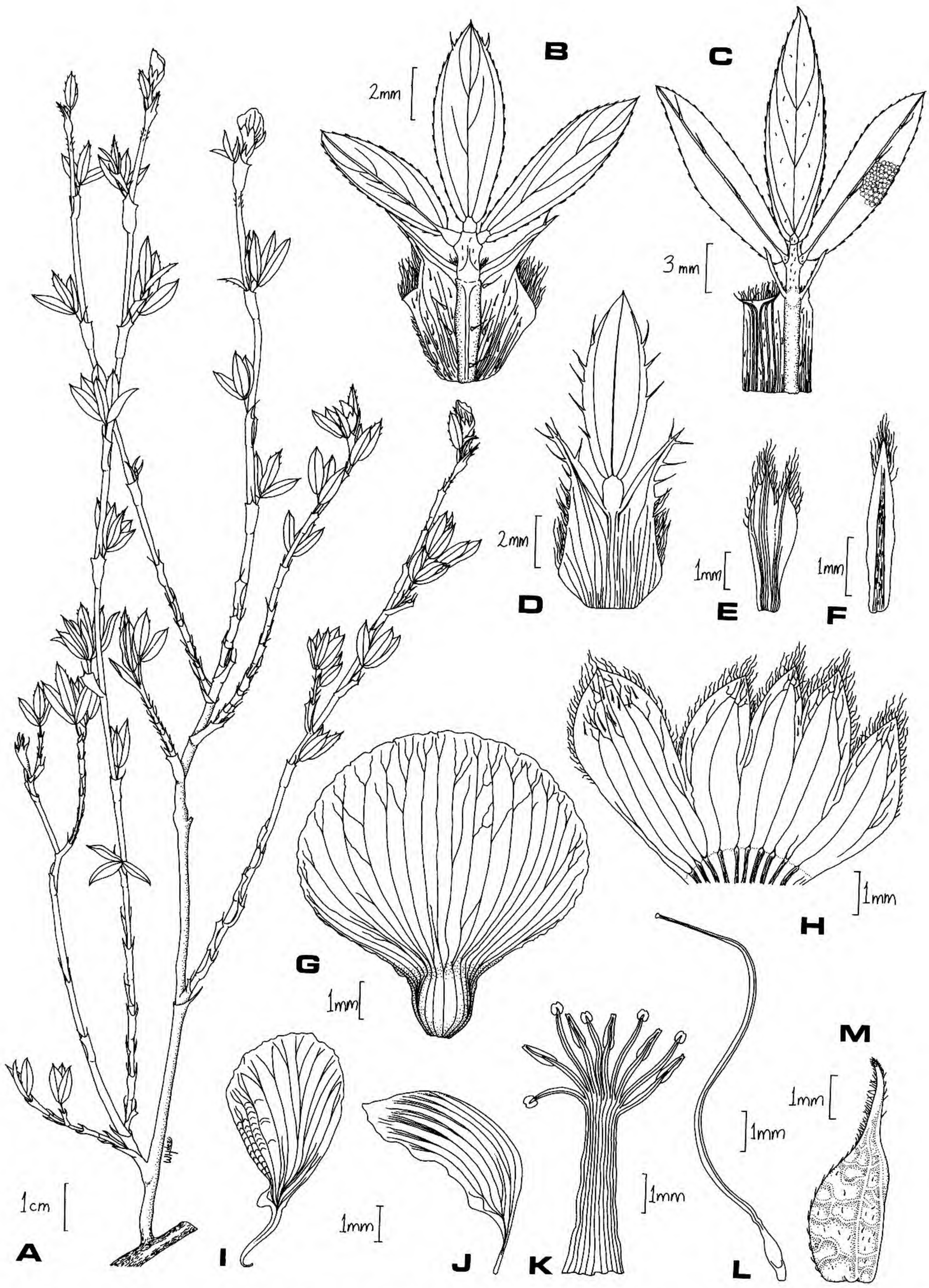

Figura 1. *Stylosanthes quintanarooensis* Gama & Dávila. —A. Hábito. —B. Bráctea más externa, trifoliolada. —C. Estípula trifoliolada. —D. Bráctea más externa, unifoliolada. —E. Bractéola externa. —F. Bractéola interna. —G. Estandarte. —H. Cáliz. —I. Ala. —J. Quilla. —K. Tubo estaminal. —L. Estilo, ovario. —M. Fruto. Dibujo basado en el holotipo *S. Gama-López 254* (MEXU).

hasta de 10 mm de largo y por carecer de un eje rudimentario (Fig. 1).

Paratipos. MÉXICO. **Quintana Roo:** Mpio. Felipe Carrillo Puerto, 3 km O de Vigía Chico, *R. Durán & I. Olmsted 243* (MEXU) [GenBank AJ416024, cp partial tRNA-Leu (UAA) gene; AJ416312, rRNA gene, ITS1 & ITS2]; 2 km O del Rancho El Ramonal, *R. Durán & I. Olmsted 729* (MEXU) [GenBank AJ416027, cp partial tRNA-Leu (UAA) gene; AJ416315, rRNA gene ITS1 & ITS2]; Km 2.7 carr. Vigía Chico–Felipe Carrillo Puerto, *R. Villanueva 435* (MEXU) [GenBank AJ416025, cp partial tRNA-Leu (UAA) gene; AJ416313, rRNA gene ITS1 & ITS2]; Km 3.5 carr.

Vigía Chico–Felipe Carrillo Puerto, *R. Villanueva 496* (MEXU) [GenBank AJ416026, cp partial tRNA-Leu (UAA) gene; AJ416314, rRNA gene, ITS1 & ITS2]; a 12 km NE de Felipe Carrillo Puerto, sobre el camino a Vigía Chico, *E. Cabrera C. & H. de Cabrera 4399* (MEXU) [GenBank AJ416316, rRNA gene ITS1 & ITS2; AJ416717, shst2 gene 3′UTR; AJ416727, STS shst1 gene; AJ416028, cp partial tRNA-Leu (UAA) gene].

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Two New Trifoliolate-Leaved Species of Cucurbitaceae (Cucurbiteae) from Central and South America

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Abstract. Two new species of Cucurbitaceae, tribe Cucurbiteae, with trifoliolate leaves are described from Costa Rica, one each in *Cayaponia* Silva Manso and *Cionosicys* Grisebach. *Cayaponia hammelii* Grayum, with large, pendent staminate flowers, ranges from Costa Rica to Pacific Ecuador, while the exceptionally large-fruited *Cionosicys guabubu* Grayum & J. A. González is restricted to Nicaragua, Costa Rica, and central Panama. Both of these new species have sometimes been misidentified as *Cayaponia granatensis* Cogniaux, a species with trilobate leaves that is dubiously present in Mesoamerica. The distinction between *Cayaponia* and the similar *Cionosicys* is discussed in some detail, and a key is provided for all species of *Cionosicys* with validly published names.

Key words: Cayaponia, Cionosicys, Colombia, Costa Rica, Cucurbitaceae, Cucurbiteae, Ecuador, IUCN Red List, Nicaragua, Panama.

The most recent classification of Cucurbitaceae (Jeffrey, 2005) divides that family into two subfamilies, with a total of 11 tribes and 14 subtribes. The overwhelmingly Neotropical tribe Cucurbiteae comprises 13 genera, by far the largest of which is *Cayaponia* Silva Manso. Although the system of Jeffrey (2005) foregoes subtribes in tribe Cucurbiteae, the same author had previously (Jeffrey, 1971) segregated *Cayaponia* into subtribe Abobrinae Pax, together with the oligotypic, New World genera *Abobra* Naudin, *Cionosicys* Grisebach, and *Selysia* Cogniaux. He regarded the relationship between *Cayaponia* and *Cionosicys* as especially close, entertaining the notion that the latter genus should "be reduced to the rank of a section within *Cayaponia*" (Jeffrey, 1971: 200), but decided to maintain *Cionosicys* on the sole basis of its larger, peponiform (vs. berry-like) fruits. That decision appears to be supported by the results of a recent molecular study (Schaefer et al., 2009) discussed later in this paper. With these considerations in mind, two new species are described below, one each in *Cayaponia* and *Cionosicys*, in anticipation of a forthcoming volume of the *Manual de Plantas de Costa Rica*.

Cayaponia

The genus *Cayaponia*, one of the largest in Cucurbitaceae with an estimated 60 species (Jeffrey, 2001), is widespread in the New World from the southern United States to Argentina, and has one or two species in Africa and Madagascar. *Cayaponia* is distinguished by its leaves usually with sessile glands abaxially (at least near the base), generally racemose inflorescences, staminate flowers with three distinct stamen filaments and coherent anthers, pistillate flowers with three broad, reflexed stigmas, and fleshy, indehiscent, generally berry-like fruits. Although a synopsis was provided by Jeffrey (1971), the most recent monograph of *Cayaponia* is that of Cogniaux (1881), leaving the genus "in fairly desperate need of a thorough revision" (Jeffrey, 1971: 201). Nevertheless, I feel confident in having been able to establish the following species as new to science.

Cayaponia hammelii Grayum, sp. nov. TYPE: Costa Rica. Puntarenas: Reserva Forestal Golfo Dulce, Península de Osa, Dos Brazos de Río Tigre, 300 m, 3 Dec. 1990, *G. Herrera 4684* (holotype, INB; isotypes, CR, MO). Figure 1.

Species nova caulibus juvenibus sicut inflorescentiae axibus dense vestitis trichomatibus glandulosis brunneolis, cirrhis plerumque simplicibus, foliis trifoliolatis membranaceis ventraliter hispidulis atque corolla florum staminatorum ca. 17–38 mm longa tubo lobis ut minimum 3-plo longiore a congeneris diversa.

Vine, sometimes hanging, monoecious; stems sparsely strigillose to moderately pilosulose and densely beset with minute, sessile or (less commonly) stalked, brownish glands, glabrescent; tendrils unbranched or (rarely) 2-branched. Leaves with petiole 1.5–6.5 cm; lamina compound, trifoliolate, with petiolules 0.05–0.9(–1.5) cm; medial leaflet 4–13.5 × 2–7.2 cm, elliptical to obovate, narrowly to broadly cuneate at the base, acuminate to caudate at the apex, remotely denticulate (especially distally) or entire, pinnately 4- to 7-nerved, membranous, glabrous and uniformly verruculate adaxially, minutely pubescent along midrib and larger main veins, uniformly

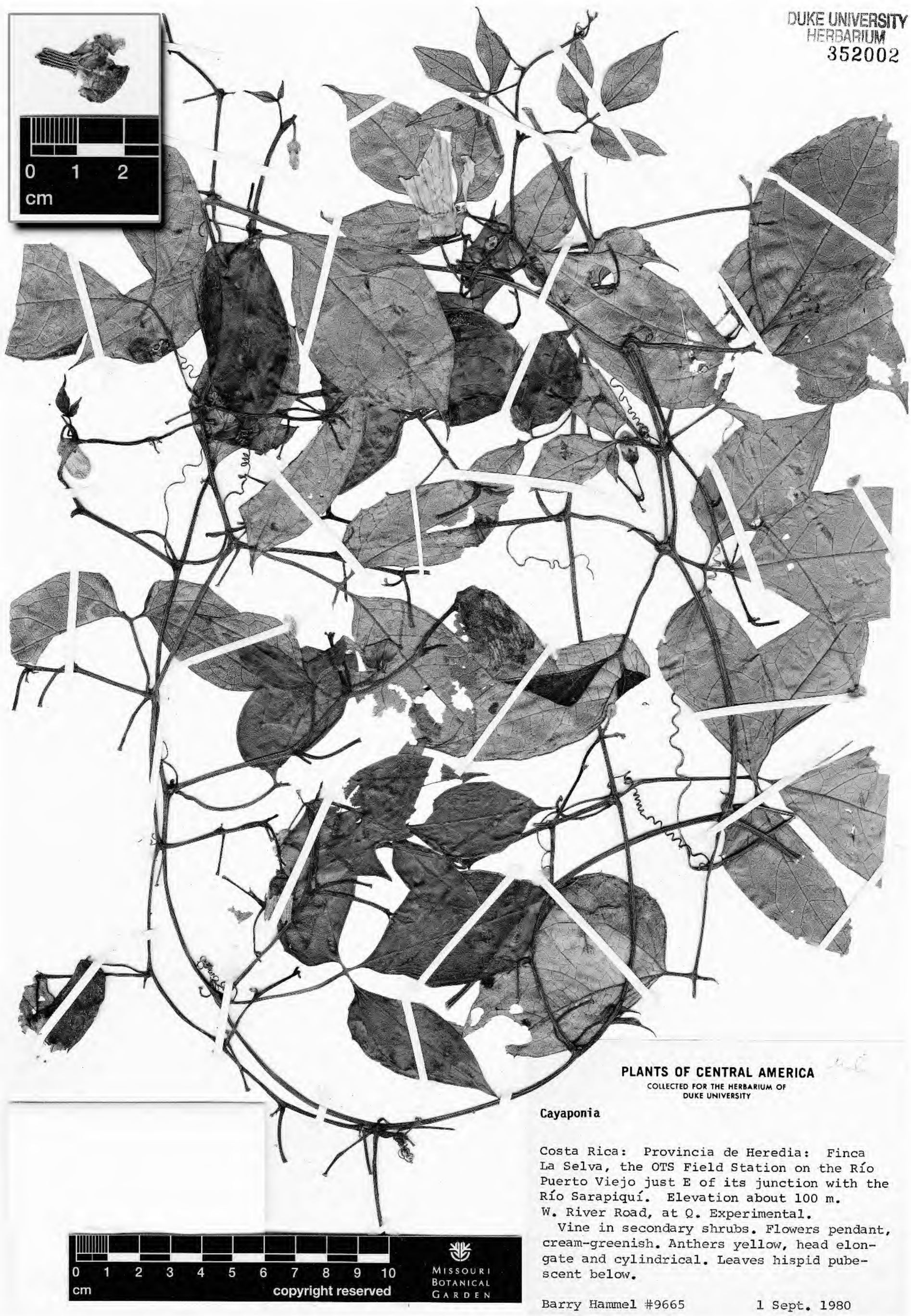

Figure 1. *Cayaponia hammelii* Grayum, flowering specimen (*Hammel 9665*, DUKE). Inset: staminate flower, with corolla partly removed to show androecium.

pustulose-hispidulous abaxially, minutely pubescent and with sessile or stalked, brownish glands along midrib and larger veins, usually with 1 to several larger, flat or immersed glands toward base; lateral leaflets asymmetrical, oblique at base, occasionally lobed (*Hammel et al. 19383*). Inflorescences of 1 solitary flower, or racemose with the rachis to ca. 4 cm. Staminate flowers pendulous, to at least 25 mm

diam., 5-merous, with pedicel 7–17 mm; hypanthium ca. 9–12 mm, ca. 11–17 mm diam., cupulate, ± uniformly and moderately pubescent, the sepals erect, ca. 0.5–2 mm, narrowly to broadly triangular; petals connate for at least 3/4 their total length in a greenish cream or yellowish white, campanulate corolla ca. 17–38 mm, ± uniformly puberulent externally with both glandular (at least distally) and nonglandular trichomes, glabrous internally toward base, villous distally; stamens inserted ca. halfway toward base of receptacle; filaments 3, distinct, 2–4 mm, with dense, unilateral tuft of uniseriate trichomes near base (on inner side); anthers coherent, forming a cylindrical head ca. 8–13 mm, the thecae tightly replicate vertically. Pistillate flowers not seen at maturity. Fruits yellowish green, 2.7–4 cm, subglobose, the surface with obscure to conspicuous polygonal pattern (at least when dried), with pedicel ca. 1–4.5 cm; seeds ca. 7 to 11, of undetermined orientation, of unspecified color when fresh, 12–14 × 8–10 mm, broadly oblong to elliptical, strongly compressed.

Distribution and habitat. *Cayaponia hammelii* occurs in tropical wet forest (Tosi, 1969), at elevations of about 50 to at least 1000 m, from Costa Rica (on both Atlantic and Pacific slopes) to the Pacific slope of Ecuador.

IUCN Red List category. Although it is relatively widespread, *Cayaponia hammelii* has been found only sporadically by collectors. It may be rare, or possibly just inconspicuous or seldom fertile. Certainly it is remarkable that it has been collected just once at the La Selva Biological Station in Costa Rica, one of the most intensively botanized sites in the Neotropics over the course of the past 30 years. This is a species of primary forest, dependent on the continued availability of that habitat. At least in Costa Rica, it has been collected principally (if not exclusively) in public or private preserves; as long as these areas remain secure, the future of *C. hammelii* should be secure as well. Because population size and extent have not been established or monitored for this species in any part of its range, it must be classified as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Phenology. Mature flowers have been gathered in January, June, September, October, and December (Costa Rica) and July (Ecuador), and fruits in February and March (Colombia), April (Panama), and June and October through December (Costa Rica).

Etymology. The epithet honors Barry E. Hammel of the Missouri Botanical Garden, my colleague on the *Manual de Plantas de Costa Rica* project, who has long taken an interest in Cucurbitaceae and was the first to collect both species described in this paper at the La Selva Biological Station in Costa Rica.

Discussion. *Cayaponia hammelii* is distinguished by the combination of generally simple tendrils, compound (trifoliolate), membranous, abaxially hispidulous leaves, and pendent staminate flowers with the petals connate for at least 3/4 of their total length in a relatively large, campanulate corolla. Also distinctive is the brownish glandular pubescence of the young stems and inflorescence axes. The berry-like fruits of this species are large enough to satisfy some concepts of *Cionosicys* (see the discussion under that heading), but have a relatively thin, brittle shell rather than a leathery rind. Some specimens of *Cayaponia hammelii* have been misidentified as *C. buraeavii* Cogniaux or *C. granatensis* Cogniaux. Although it may also have trifoliolate leaves, *C. buraeavii* occurs at higher elevations than *C. hammelii* (1300–1700 m, in Costa Rica) and has more coriaceous leaves, as well as much smaller flowers (hypanthium ca. 4–4.5 mm diam.; corolla ca. 6–7 mm) and smaller fruits (ca. 1.2–1.5 cm) with fewer seeds (2 or 3). According to its protologue (Cogniaux, 1881: 794), *C. granatensis* differs from *C. hammelii* in having trilobate leaves ("ultra medium trilobatis"), as well as 3-branched tendrils and larger (ca. 6 × 3–4.5 cm), ovoid fruits that are (as specified in Cogniaux's key to *Cayaponia* species) 1-seeded. The *Cayaponia* species key in Cogniaux (1881: 739–743) does not accommodate a species with the combination of characters seen in *C. hammelii*, viz., simple tendrils, trifoliolate leaves with petiolulate, abaxially hispidulous leaflets, and flowers with the sepals much shorter than the hypanthium. I have checked all seven *Cayaponia* species described subsequently from within the geographic range of *C. hammelii*, as well as the trifoliolate-leaved species described from other regions (e.g., Jeffrey, 1978; Gomes-Klein, 2003; Gomes-Klein & Pirani, 2005), and found none that matches.

Some further consideration of *Cayaponia granatensis* is warranted, as that name has been applied uncritically in herbaria to several different *Cayaponia* species (probably at least four in the Mesoamerican region) with trilobate leaves, as well as to some species (at least three) of both *Cayaponia* and *Cionosicys* with trifoliolate leaves. My concept of *C. granatensis* is based on the protologue, supplemented by color photos of an isolectotype (*Karsten s.n.*, BR; lectotype designated by Jeffrey, 1971: 217) and one of the other original syntypes (*Triana 2998*, P), both of which were collected in Meta Department, Colombia. I have also seen a modern collection from Meta Department bearing Jeffrey's annotation (*Callejas &*

Marulanda 6009, MO). Although none of this material is floriferous (and flowers were unknown to Cogniaux), *C. granatensis* is well characterized vegetatively by its consistently simple, trilobate leaves. The various trilobate-leaved *Cayaponia* species occurring in the Mesoamerican region have yet to be rigorously sorted out, and it is possible that one may prove conspecific with the type of *C. granatensis*; however, the last-mentioned name may be safely rejected for the trifoliolate-leaved species of *Cayaponia* and *Cionosicys* to which it has been applied, including both of those described herein.

I have seen just a few pistillate flowers of *Cayaponia hammelii* (*Estrada et al. 1862*; *Herrera & Martínez M. 2219*), in what I assume to be very young bud. Because I do not definitely know the mature pistillate flowers of this species, I am unable to assign it to one of the two sections accepted by Jeffrey (1971), whose infrageneric classification relies solely on stigma morphology.

Paratypes. COSTA RICA. **Cartago:** Parque Nac. Barbilla, Sendero Barbilla, por la loma, *E. Mora & E. Rojas 1598* (CR, INB). **Heredia:** Finca La Selva, OTS Field Station on Río Puerto Viejo just E of jct. with Río Sarapiquí, *B. Hammel 9665* (DUKE [2]); Cantón de Sarapiquí, La Virgen a Magsasay por La Tirimbina, *B. Hammel, Jiménez, Lépiz, Ramírez & Rueda 19383* (INB). **Limón:** Cantón de Matina, Cordillera de Talamanca, entre Río Barbilla y Quebrada Cañabral, *G. Herrera & H. Martínez M. 2219* (INB). **Puntarenas:** Cantón de Golfito, Península de Osa, Estero Guerra de Sierpe, *A. Rodríguez 744* (CR, INB). **San José:** Pérez Zeledón, Savegre Abajo de Río Nuevo, *A. Estrada, J. Solano, H. Gómez & H. Cordero 1862* (CR, MO). PANAMA. **Coclé:** Alto Calvario, New Works, *J. P. Folsom & J. Kauke 2631* (MO). COLOMBIA. **Antioquia:** Mpio. Frontino, Vereda Venados, Parque Nac. Nat. Las Orquídeas, Quebrada La Manzanares, *J. Pipoly, J. Ramírez, J. Arias, O. Álvarez, G. Muñoz & F. Ramírez 18228* (MO, NY). **Valle:** Mpio. Restrepo, Vereda Río Bravo, Vía El Pital La Cristalina, Proyecto Calima III CVC, *W. Devia 1146* (MO). ECUADOR. **Pichincha:** 24–25 km by rd. E of Patricia Pilar, *G. L. Webster, R. Lockwood & K. Steiner 22789* (MO).

Cionosicys

The genus *Cionosicys* has generally been regarded (following Jeffrey, 1971) as comprising three or four species, ranging from southern Mexico to Panama and the Greater Antilles (Cuba and Jamaica). *Cionosicys* was established by Grisebach (1864) on the basis of the Jamaican endemic *C. pomiformis* Grisebach and persisted as monospecific for more than a century thereafter. In 1971, Jeffrey moved *Cionosicys* into subtribe Abobrinae (from subtribe Cucurbitinae, where he had previously maintained it), emphasizing the simple (unbranched) tendrils of *C. pomiformis*. This action brought *Cionosicys* into closer proximity with *Cayaponia* and precipitated Jeffrey's transfer, in the same paper, of two large-fruited, Mesoamerican species, then known as *Cayaponia excisa* (Grisebach) Cogniaux and *C. macrantha* Pittier, into *Cionosicys* (despite the fact that both have generally branched tendrils). Although Jeffrey (1971: 200) admitted that his reconfigured *Cionosicys* could be distinguished from *Cayaponia* "solely by the fleshy peponiform fruit, as contrasted with the typical fibrous berry of the latter," he considered this to be an "important enough" biological difference to justify their generic segregation.

There have been no additional revisionary studies involving either *Cayaponia* or *Cionosicys* since Jeffrey (1971). However, the genus *Cionosicys* has been maintained in a number of floristic accounts, mostly authored by contemporary Cucurbitaceae specialists. For the most part, the distinction between *Cayaponia* and *Cionosicys* has been expressed, in these accounts, in dichotomous keys, often by means of artificially constructed couplets designed to expediently pigeonhole the local taxa. The couplet employed by Adams (1972) to separate *Cionosicys pomiformis* from *Cayaponia* relied on inflorescence structure: solitary or clustered flowers or racemes in the former, panicles in the latter. Dieterle (1976) utilized the size of the staminate flowers (petals 5–7 mm long in *Cayaponia* vs. 15–20 mm in *Cionosicys*) and the size and nature of the fruits (1–2 cm long and thin-walled in *Cayaponia* vs. 3–5 cm and thick-walled in *Cionosicys*). Nee (1993) also employed fruit size (0.8–1 cm diam. in *Cayaponia* vs. 6–12 cm diam. in *Cionosicys*), as well as seed number (2 or 3 in *Cayaponia* vs. ca. 15 to 25 in *Cionosicys*). Lira Saade (2004: 21) added seed orientation ("en posición vertical" in *Cayaponia* vs. "en posición horizontal o ligeramente ascendentes sólo en la porción inferior del fruto" in *Cionosicys*). Although these differences may seem dramatic, it must be noted that Lira Saade treated a single *Cayaponia* species, *C. racemosa* (Miller) Cogniaux, and both Dieterle and Nee only *C. attenuata* (Hooker & Arnott) Cogniaux and *C. racemosa*; these two species have among the smallest flowers and fruits in the genus, as well as the fewest seeds per fruit. Wunderlin (1978), who had six *Cayaponia* species to contend with for Panama, quoted the standby fruit difference (berry vs. peponiform), but also introduced a new character: petal connation. According to his keys to genera, the flowers of *Cayaponia* are characterized by having the "petals free nearly to the base," as opposed to "connate over half their length" in *Cionosicys* (Wunderlin, 1978: 287). This notion, however, was contradicted by his own genus description, in which the staminate corolla of *Cionosicys* is said to be 5-lobate almost to the base. Moreover, Wunderlin's illustration of *Cionosicys*

macranthus (Pittier) C. Jeffrey depicted a flower with distinct petals. Grisebach (1864), Dieterle (1976), Nee (1993), and Jeffrey (2001) converged in describing the staminate corolla of *Cionosicys* as deeply 5-parted or 5-parted almost to the base, although Dieterle's (1976: 323) illustration of *C. macranthus* appears to show the staminate petals connate to near the middle or beyond. Jeffrey (2001), in his key to genera, characterized *Cayaponia* as having small, numerous flowers in racemes and fruits 1–2 cm long, as opposed to *Cionosicys*, which has large, solitary or less numerous flowers and fruits 3–6 cm long. However, closer inspection of his species descriptions reveals overlap in both floral and fruit dimensions.

My own observations only serve to further blur the distinction between *Cayaponia* and *Cionosicys*. While it may be true that *Cionosicys excisus* (Grisebach) C. Jeffrey and *C. macranthus* have many solitary flowers, at least the former also has flowers in racemes; furthermore, most *Cayaponia* species have at least some solitary flowers, and in a few (e.g., *C. macrocalyx* Harms) the flowers are principally or exclusively solitary. The staminate corolla in *Cionosicys excisus* and *C. macranthus* measures ca. 15–25 mm, which is indeed relatively long by *Cayaponia* criteria; nevertheless, corollas of comparable length occur in numerous *Cayaponia* species, e.g., *C. glandulosa* (Poeppig & Endlicher) Cogniaux (8–21 mm), *C. macrocalyx* (ca. 11–38 mm), and *C. sessiliflora* Wunderlin (ca. 8–17 mm). Many *Cayaponia* species have the petals of the staminate flowers distinct to near the base, as reported for *Cionosicys* (see above), but in other species they are connate to near the middle (*Cayaponia glandulosa*) or beyond (*C. macrocalyx*). Most of the floras cited previously describe the fruits of *Cionosicys excisus* and *C. macranthus* as ca. 3–7 cm in length (or diam.; they are subglobose), and my measurements concur. Again, this is on the large side for *Cayaponia*, but overlap does occur: the fruits of *Cayaponia granatensis* measure ca. 6 cm (Cogniaux, 1881: 794), those of *C. macrocalyx* ca. 2.5–3.5 cm, and those of *C. sessiliflora* ca. 3–4.5 cm. The fruits of *Cionosicys pomiformis* were reported to have 27 seeds (9 per cell) by Grisebach (1864), while Nee (1993) characterized the genus as having fruits with ca. 15 to 25 seeds. *Cayaponia* typically has just one to 12 seeds per fruit (Cogniaux, 1881), but *C. glandulosa* may have as many as 15 (Wunderlin, 1978). To some extent, seed number is no doubt correlated with fruit size; seed orientation may be as well, and is often difficult or impossible to evaluate in the herbarium.

But if *Cionosicys* fruits cannot be sharply distinguished from those of *Cayaponia* on a mensural basis, there does seem to be a qualitative difference, as generally expressed by the adjective peponiform. The fruits of *Cionosicys excisus* and *C. macranthus* have a thick, leathery rind, and their seeds are firmly embedded in a dense pulp that adheres tightly to the inner surface of the rind. By contrast, typical *Cayaponia* fruits (when dried) have a relatively thin, brittle shell (e.g., as in *Passiflora ligularis* Jussieu), and the mass of seeds and pulp pulls away from the inner surface of the shell. The *Passiflora* L. analogy is worthwhile, for within that genus (which, admittedly, is much larger than *Cayaponia*) can be found a greater range of fruit sizes and types than occurs even in *Cayaponia* and *Cionosicys*, from thin-walled berries ca. 1 cm long (e.g., *P. apetala* Killip) to leathery-rinded, peponiform fruits 10–30 cm long (e.g., *P. ambigua* Hemsley, *P. quadrangularis* L.). Similar variation in fruit types can be seen in *Solanum* L. (e.g., *S. americanum* Miller, with tiny berries 0.5–0.8 cm diam., vs. *S. gomphodes* Dunal and *S. lycocarpum* A. St.-Hilaire of South America, with fruits ca. 15 cm diam.; M. Nee, pers. comm.).

The morphological distinction of *Cionosicys* from *Cayaponia* would thus distill to: larger-than-average (3–6+ cm), peponiform fruits with more than 14 seeds. However tenuous this may seem, a recent molecular analysis of Cucurbitaceae, based on chloroplast DNA sequences, provides some cladistic support for the generic separation. This extensive study (Schaefer et al., 2009), involving all but one of the 115 genera in the family and a quarter of its species, portrayed most of Jeffrey's (2005) tribes as monophyletic, including the Cucurbiteae. His subtribes did not generally fare so well, but the four genera of subtribe Abobrinae sensu Jeffrey (1971) do comprise a monophyletic group, albeit nested among genera of his subtribe Cucurbitinae. *Cionosicys* (represented by *C. macranthus*) was basal within this group, sister to the clade harboring *Abobra*, *Cayaponia*, and *Selysia* (Schaefer et al., 2009: 845).

Cionosicys guabubu Grayum & J. A. González, sp. nov. TYPE: Costa Rica. Guanacaste: Parque Nac. Rincón de la Vieja, sector del canal, 1 km al E de la Administración, 800–900 m, 4 Mar. 1991, *G. Rivera 1144* (holotype, INB; isotypes, CR, MO). Figures 2, 3.

Species insignis foliis (2 vel)3(ad 5)-foliolatis, floribus staminatis grandibus corolla aliquanto carnosa antheris capitulum globosum formantibus thecis valde contortis atque fructibus magnis pulpa alba seminibus numerosis a speciebus mihi notis bene distincta.

Vine or liana, climbing to at least 30 m, apparently monoecious; stems glabrate; tendrils 2-branched (with 1 branch sometimes vestigial). Leaves with petiole ca. 0.9–5.5(–7) cm; lamina compound, trifoliolate (rarely

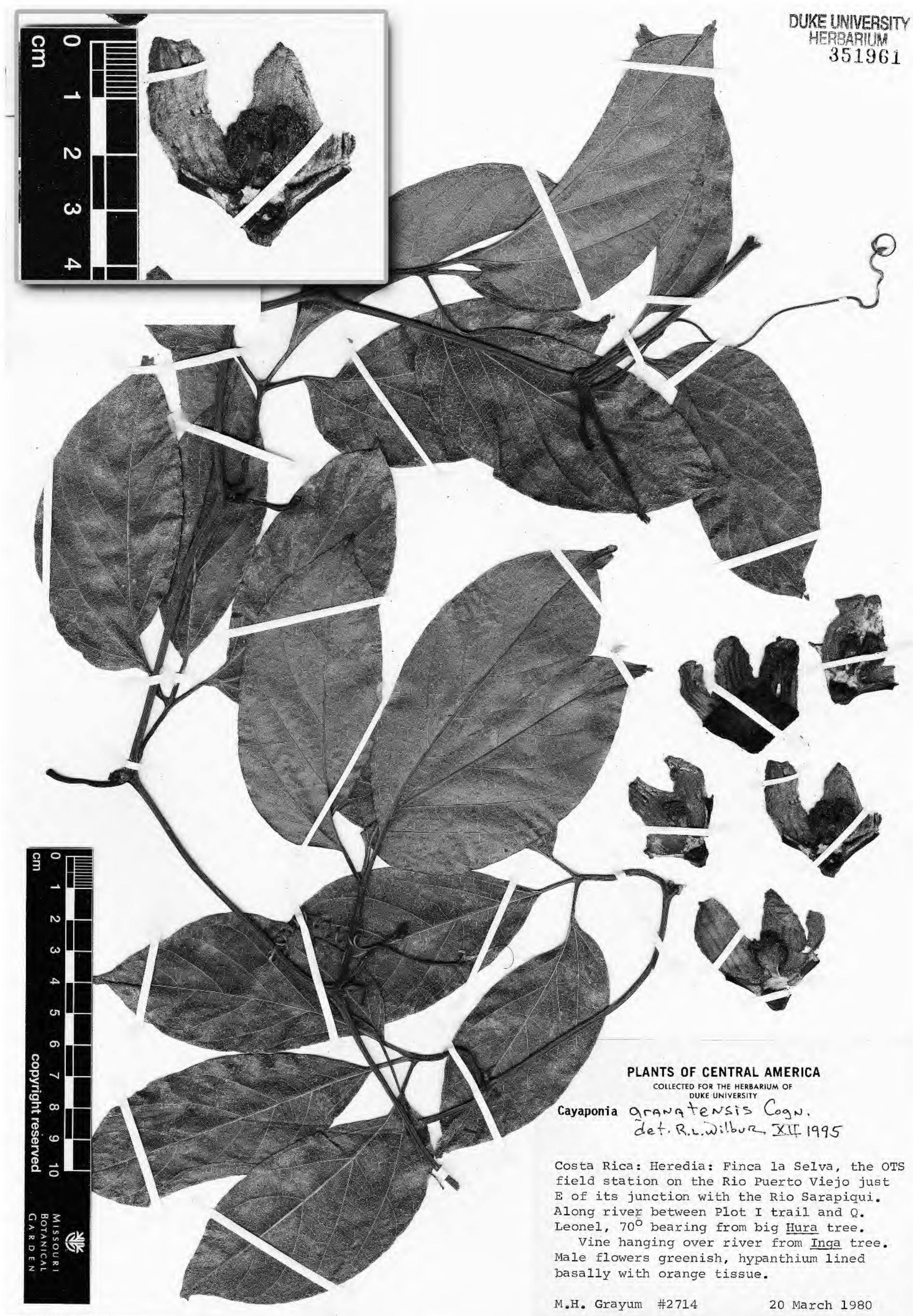

Figure 2. *Cionosicys guabubu* Grayum & J. A. González, flowering specimen (*Grayum 2714*, DUKE). Inset: staminate flower, with corolla partly removed to show androecium.

2- or pedately 4- or 5-foliolate), with petiolules 0.6–2(–2.3) cm; medial leaflet 6–18(–21+) × 2.8–7(–8) cm, elliptical to oblong or ± narrowly obovate, cuneate to short-attenuate at the base, ± abruptly short-acuminate at the apex, minutely denticulate or subentire, pinnately 4- to 7-nerved, chartaceous or subcoriaceous, glabrous on both surfaces (except sometimes sparsely and minutely pubescent along

Figure 3. *Cionosicys guabubu* Grayum & J. A. González, fruiting specimen (*Haber ex Bello C. & Lierheimer 4399*, MO).

the major veins), minutely verruculate adaxially, uniformly glandular-puncticulate abaxially and with scattered larger, immersed glands (most in proximity of midrib and major veins); lateral leaflets asymmetrical, oblique at the base, rarely coarsely dentate to lobed basiscopically or with the lobe pedately distinct (*Hammel 24504*; *Rojas 285*). Inflorescences usually of 1 solitary flower or 2 or 3 fasciculate flowers (occasionally racemose with the rachis to ca. 5 cm). Staminate flowers ca. 35–45 mm diam., 5-merous,

with pedicel ca. 5–40 mm; hypanthium basally orange within, ca. 13–21 mm, 20–30 mm diam., broadly obconical, glabrous (or with scattered, minute trichomes along the margin), the sepals ± erect, 1–3.5 (–8; *Chávez 504*) mm, subulate to narrowly triangular; petals distinct to near the base or connate for up to ca. 1/2 their length in a green or yellow-green, apparently campanulate corolla 11–24 mm, fleshy, longitudinally ridged externally, densely pilose-tomentose with uniseriate trichomes on both surfaces (or sometimes glabrescent within); stamens inserted in proximal 1/3 of receptacle; filaments 3, distinct, 3–5 mm, stout, with dense, unilateral tuft of uniseriate trichomes near base (on inner side); anthers coherent, forming a yellowish subglobose head (8–)12–13 mm, the thecae strongly contorted. Pistillate flowers not seen. Fruits green, sometimes (*Merello et al. 3050*) with lighter green stripes (the pulp white, cottony and juicy when ripe; *Hammel et al. 17410*), ca. 7–11 cm, oblate to globose, ± lustrous, with pedicel 1–3.4 cm; seeds numerous (about 30 noted; *Hammel 8137*), horizontal to descending or subvertical proximally (*Haber ex Bello C. & Lierheimer 4399*; *Hammel 8137*), atropurpureous (*Gómez et al. 22767*) or black (*Hammel et al. 17410*; *Rivera & Hoomans 1753*), 15–35 × 10–20 mm, subrectangular to oblong or narrowly elliptical, ± strongly compressed.

Habitat and distribution. *Cionosicys guabubu* occurs in tropical wet forest (Tosi, 1969), at elevations of about 50–1200 m, in Nicaragua (two collections), Costa Rica, and central Panama (two collections). Although most collections are from the Atlantic slope, the species is also found on the Pacific slope in the northern Costa Rican cordilleras (Cordillera de Guanacaste and de Tilarán).

IUCN Red List category. Until recently, the only collections of *Cionosicys guabubu* known to us were from the La Selva Biological Station, Costa Rica, and housed at DUKE. Additional collections have since accrued to expand the geographic range, and though it is still relatively small, we can now cite records from all seven Costa Rican provinces, as well as a few from Nicaragua and Panama. As in the case of *Cayaponia hammelii*, the fate of *Cionosicys guabubu* is intertwined with that of the primary forest habitat to which it is confined. Most (if not all) of the vouchered populations of *C. guabubu* are in public or private preserves, and as long as these areas remain pristine, the species should be safe. Even though this species is presently common at some sites (e.g., in Costa Rica's Parque Nacional Braulio Carrillo), it may have declined in others (e.g., the La Selva Biological Station, where it has not been seen in nearly 30 years). Because population size and extent have not been rigorously established or monitored for *C. guabubu* in any part of its range, it must be classified as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Phenology. Flowering has been documented from February through April, and mature fruits from February through May. At anthesis, the flowers are said to have an aroma of "mango verde" or "follaje de mango" (*Hammel 24495*).

Common name. Guabubu (*Coronado et al. 1434*, Nicaragua).

Etymology. The epithet is taken from the common name indicated on the label of *Coronado et al. 1434* (MO), from Nicaragua.

Discussion. *Cionosicys guabubu* may be recognized by its compound (typically trifoliolate) leaves; large staminate flowers, with the corolla somewhat fleshy and the anthers forming a subglobose head, with the thecae highly contorted; and oblate to subglobose fruits, with white pulp and numerous seeds. It is distinct from the other three described species of *Cionosicys* by virtue of its compound, generally trifoliolate (vs. simple and unlobed to lobed) leaves and highly contorted (vs. tightly replicate) anther thecae, and its fruits are probably the largest known in *Cionosicys*. We have no precise quantitative data on fruit size for the Jamaican *C. pomiformis*, but Grisebach (1864: 288) described the fruits as the "size of an orange." We imagine that the orange Grisebach had in mind would be on the small side, by modern standards, while the fruits of *C. guabubu* attain nearly the size of a modern grapefruit. The key to genera of Cucurbitaceae in Adams (1972: 501) requires that the fruits of *C. pomiformis* be "about 7 cm in diameter." The white pulp of *C. guabubu* fruits provides an additional distinction from the sympatric *C. macranthus*, the fruits of which have orange to red pulp (the fruits of the more northern *C. excisus* also have whitish pulp).

As in the case of *Cayaponia hammelii*, herbarium specimens of *Cionosicys guabubu* have often been misidentified using the catch-all name *Cayaponia granatensis*, properly applied to a species with trilobate leaves as well as smaller, berry-like fruits. In Cogniaux's (1881) key to *Cayaponia* species, *Cionosicys guabubu* keys directly to *Cayaponia petiolulata* Cogniaux, based on a specimen from Bahia, Brazil. However, the latter species differs in its much longer stamen filaments (20–30 mm) and shorter anther head (ca. 8 mm). Because of its large, subglobose fruits, *Cionosicys guabubu* has sometimes been identified as *Fevillea* L., a distantly related genus (Schaefer et al., 2009)

in subfamily Zanonioideae; *Fevillea* differs in its simple (in the two Mesoamerican species), eglandular leaves, flowers with five distinct stamens and three distinct styles, and fruits with a distal, circumferential scar.

The highly contorted anther thecae of *Cionosicys guabubu* are a particularly distinctive feature of this species. Those of *C. pomiformis* have been described as "bent upwards and downwards, with 3 parallel anfractuosities" (Grisebach, 1864: 288); "longitudinaliter triplicatis" (Cogniaux, 1881: 516); or "folded vertically into an erect column" (Adams, 1972: 501). These characterizations also accord well with published descriptions of the anthers of both *C. excisus* and *C. macranthus*, as well as many *Cayaponia* species, and corroborate our own observations. In *Cionosicys excisus* and *C. macranthus*, the anther thecae are tightly replicate vertically, forming a cylindrical head (vs. subglobose in *C. guabubu*). The allusions to verticality refer to the tight folding of the thecae in long, straight segments (which are themselves easily mistaken for whole, uncurved anthers); by contrast, no significant portion of any anther in *C. guabubu* could reasonably be characterized as "vertical" or "straight."

We have not seen any pistillate flowers that can definitely be identified as belonging to *Cionosicys guabubu*.

The following key will suffice to distinguish those species of *Cionosicys* with validly published names:

Key to the Described Species of *Cionosicys*

1a. Leaves compound, 3(to 5)-foliolate; anthers forming a subglobose head, the thecae highly contorted; mature fruits ca. 7–11 cm . . . . . *C. guabubu*

1b. Leaves simple, unlobed to deeply 3- to 7-lobed; anthers forming a cylindrical head, the thecae tightly folded vertically; mature fruits ca. 3–7 cm.

2a. Sepals of staminate flowers 1–3(–6) mm, dentiform to narrowly or broadly triangular, broadest at base; ripe fruits with orange to red pulp; southern Mexico to Panama. . . . . *C. macranthus*

2b. Sepals of staminate flowers 9–18 mm, elliptical or ovate to oblong-lanceolate, constricted at base; ripe fruits with whitish pulp (color unknown in *C. pomiformis*); southern Mexico, Belize, and Guatemala, Cuba, Jamaica.

3a. Tendrils simple or 2- or 3-branched; corolla ca. 10–30 mm; Mexico, Belize, and Guatemala, Cuba . . . . . *C. excisus*

3b. Tendrils simple; corolla ca. 35–40 mm; Jamaica. . . . . *C. pomiformis*

The relationship between *Cionosicys excisus* and *C. pomiformis* bears closer scrutiny, as these species would seem to be extremely similar, yet have apparently never been compared directly.

Paratypes. NICARAGUA. **Jinotega:** Mpio. Wiwilí, Reserva de Bosawas, comun. San Andrés, Caño Pilawas, *I. Coronado, M. Barrios, F. Rojas & G. Pérez 1434* (MO). **Zelaya [Región Autónoma del Atlántico Norte]:** Caño El Hormiguero, *J. J. Pipoly 5917* (MO). COSTA RICA. **Alajuela:** Cantón de Upala, Parque Nac. Guanacaste, Cordillera de Guanacaste, entre Quebrada Grande y Nueva Zelandia, *R. Aguilar, K. Taylor, D. García & R. Espinoza 3164* (CR, INB); Arenal Volcano, from macadamia field to river and back to base of mountain, *V. Funk et al. 10761* (CR); Z. P. Arenal-Monteverde, Río Peñas Blancas valley, Eladio's Refugio, Monteverde Reserve, *W. Haber & E. Cruz 11962* (INB); Reserva Biol. Monteverde, Río Peñas Blancas, *W. Haber & E. Bello 8459* (CR); San Ramón, Reserva Biol. A. M. Brenes, camino de entrada a la estación, *J. Gómez-Laurito et al. 12633* (CR, USJ). **Cartago:** Sector Río Guayabo, El Ceibo, *G. Rivera & Y. Hoomans 1753* (CR, USJ). **Guanacaste:** Parque Nac. Guanacaste, Cordillera de Guanacaste, Cerro Cacao, Estación Cacao, *C. Chávez 504* (INB); La Cruz Cantón, along trail from Estación Pitilla to ridge SW thereof, Cordillera de Guanacaste, *M. H. Grayum 12928* (INB, MO); El Dos de Tilarán, 4 km N, Cerro La Chirripa, Atlantic slope rain forest, *W. A. Haber ex E. Bello C. & L. Lierheimer 4399* (MO); Parque Nac. Guanacaste, Estación Pitilla 4.5 km al N, hacia Finca La Pasmompa, *B. Hammel, M. Chavarría, G. Herrera, R. Robles & Grupo de Estudiantes de Biodiversidad 17410* (INB). **Heredia:** Finca La Selva, OTS Field Station on Río Puerto Viejo just E of jct. with Río Sarapiquí, *M. H. Grayum 2714* (DUKE [2]), *B. Hammel 7856* (DUKE), *B. Hammel 8009* (DUKE [2], LSCR), *B. Hammel 8137* (DUKE). **Limón:** Cantón de Talamanca, Alto Lari, entre Río Dapari y Río Lari, *R. Aguilar & H. Schmidt 1020* (CR, INB); Río Segundo, Asunción, *J. Berrocal et al. 41* (CR); path beyond Río Sucio, Braulio Carrillo, *L. D. Gómez P., I. A. Chacón G. & G. Herrera Ch. 22767* (CR); Parque Nac. Braulio Carrillo, Sendero Botarama, Quebrada González, *B. Hammel 24495* (INB), *B. Hammel & R. Hammel 24482* (INB); A. C. Llanuras de Tortuguero, Pococí, Estación Aguas Frías, *E. Rojas 285* (INB). [**Puntarenas:**] Cedral de Montes de Oro, Mar. 1959, *Lankester & Jiménez s.n.* (CR 41408). **San José:** Parque Nac. Braulio Carrillo, ca. 1 km carretera arriba del puente sobre el Río Sucio, *B. Hammel 24504* (INB). PANAMA. **Colón:** Teck Cominco Mining Concession, Colina Camp, *M. Merello, J. J. Calvache & J. I. González 3050* (MO); Teck Cominco Petaquilla mining concession, *G. McPherson 19825* (MO).

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Hoya persicinicoronaria (Apocynaceae, Asclepiadoideae), a New Species from Hainan, China

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Abstract. The new species *Hoya persicinicoronaria* S. Y. He & P. T. Li (Apocynaceae, Asclepiadoideae) is described and illustrated from Hainan, China. The morphology of the related species *H. pottsii* Traill and *H. liangii* Tsiang are compared to the new species, which differs in its indumentum, leaf arrangement, leaflet pattern, leaf shape, apex, and size, calyx shape, and corolla color.

Key words: Apocynaceae, Asclepiadoideae, China, Hainan, *Hoya*, IUCN Red List.

Hoya R. Brown is a genus of about 60 species distributed in tropical Asian Malesia and Australia, and with 32 species in India (Hooker, 1885). In his later study, Costantin (1912) maintained that the genus comprised approximately 70 species across tropical Asia and Australia. More recently, about 200 species were considered to be distributed throughout the moister parts of the eastern tropics from Nepal and Ceylon to southern China, northern Australia, and the Pacific region, with 29 species in India (Jagtap & Singh, 1999). Tsiang and Li (1977) recognized the genus as having ca. 200 species distributed from eastern Asia to Oceania, and 22 species, three varieties, and two forms in China. Thirty-three species and one variety of *Hoya* are currently recognized in China (Gilbert et al., 1995; Li et al., 1995; He et al., 2009b), with Yunnan, Hainan, Guangdong, and Guangxi provinces as the centers of distribution, and with 12 species recorded in Hainan (Li et al., 1995; He et al., 2009a, b). Forster and Liddle (1996) recognized the genus as having more than 300 species distributed primarily in Malesia, particularly the Philippines, New Guinea, the western Pacific Islands, and Asia, including the Indian subcontinent; they recognized six native species in Australia, among which were one endemic and one naturalized species. Regardless of which circumscription is recognized, the International Plant Names Index (<http://www.ipni.org>) lists nearly 500 named species in *Hoya* in the world so far.

Hoya is characterized as a taxon by its opposite leaves and simple leaflet pattern (Hooker, 1885; Costantin, 1912; Li et al., 1995; Jagtap & Singh, 1999). However, four unusual specimens of *Hoya* were collected by the authors while on two expeditions to Bawangling in Hainan Province in 2007 and 2008. After comparison with specimens at CANT, KUN, HITBC, and IBSC and literature surveys, these collections prove to be a new species. The new species is distinguished by leaves that are alternate, opposite, or whorled and a leaflet pattern that is either simple or ternate, which is rare for *Hoya*, with only *H. dickasoniana* P. T. Li previously described with opposite and whorled leaves (Li, 1994).

Hoya persicinicoronaria S. Y. He & P. T. Li, sp. nov. TYPE: China. Hainan Prov.: Bawangling, on a tree in montane tropical rainforest, 19°06′N, 109°06′E, 214 m, 8 Aug. 2007, *S. Y. He & J. Y. Lin 0708086* (holotype, CANT, photo at MO). Figure 1.

Haec species *Hoyae liangii* Tsiang valde affinis, sed ab ea foliis alternis oppositis vel verticillatis, simplicibus vel trifoliolatis, calyce extra strigoso, corolla intra albida et dilute persicina atque corona intra persicina differt.

Epiphytic vine, glabrous except for the calyx and corolla; stems thick, terete, with tumid nodes evident, young stems dark green, mature ones gray-white. Leaves alternate, opposite, or whorled, leaflet pattern simple or ternate, fleshy; blades similar and flat, elliptic or obovate, 7–10 × 4–5 cm, ca. 0.3 cm thick; blade surfaces reticulate, with the midrib and lateral vein evident or indistinct, lateral veins in 3 to 5 pairs, adaxially green, abaxially light green, base green; blade with base rounded or cuneate, apex rounded, cuspidate, or retuse; petiole 0.5–1 cm, ca. 0.6 diam., green or gray-white, adaxially with 1 or 2 glands. Peduncle 3.5–7 × 0.4–1 cm, acropetally green, pedicel ca. 1.5 cm, yellowish green; perennial umbel, 5 to 20 flowers; calyx elliptic, apex rounded, externally strigose, yellowish green; corolla pubescent on upper surface, ca. 1.3 cm diam., lobes ca. 3 × 3.5 mm, white with peach markings, lightly reflexed

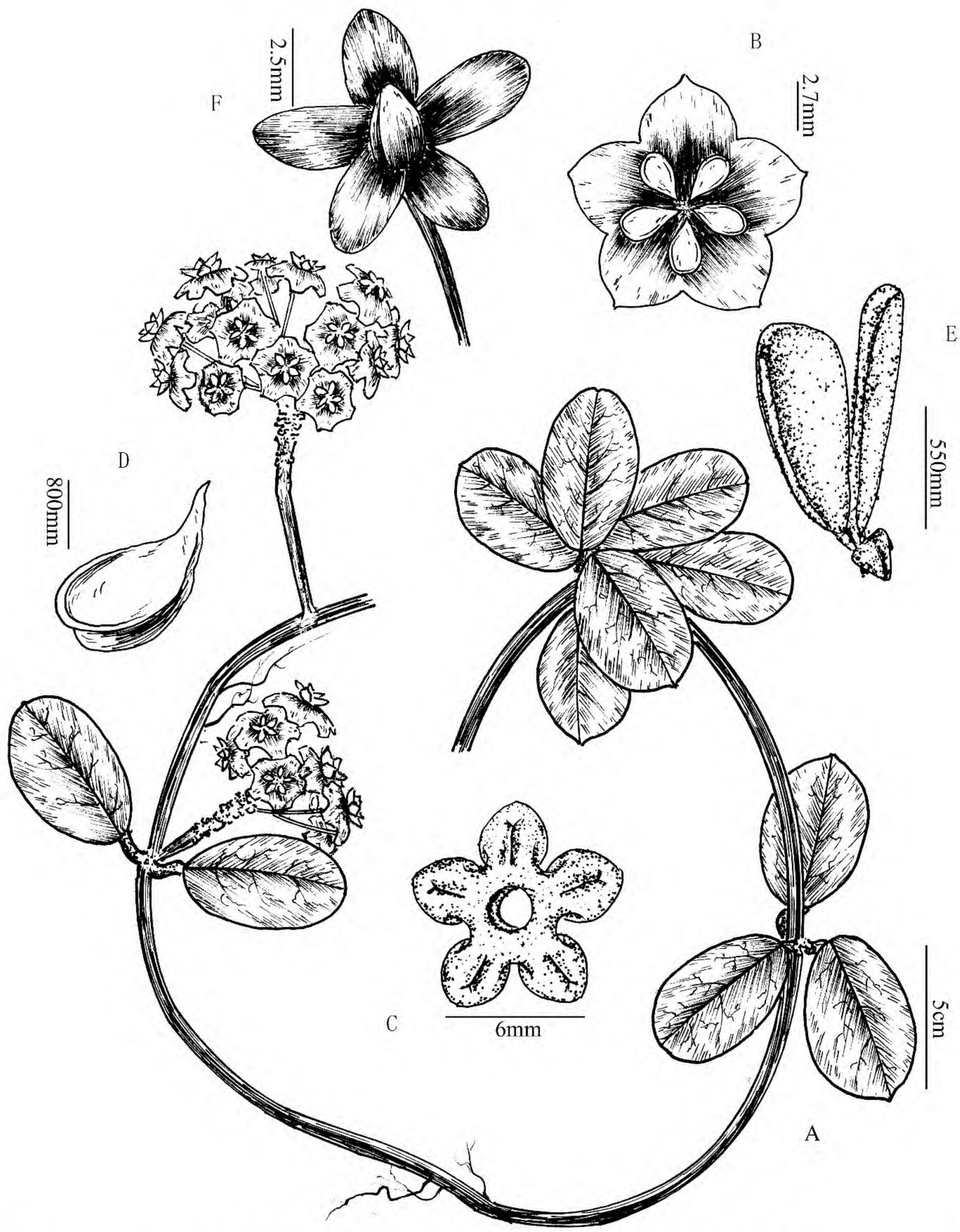

Figure 1. *Hoya persicinicoronaria* S. Y. He & P. T. Li. —A. Flowering stem. —B. Flower. —C. Outer corona. —D. Corona, side view. —E. Pollinarium. —F. Calyx and ovary. Drawn from the holotype (*He et al. 0708086*, CANT).

toward the outer lobe; corona lobes waxy, scales elliptic, pumpkinseed-shaped, with the scales of the corona toward the center with ascending tips, cuspidate, the outer end obtuse, the margins with a hump above the middle, peach-colored, lobe dorsally channeled in the middle, but not to apex, with a branch, lobe ca. 2.7 × 2 mm, ca. 2 mm thick; stigma well developed; pollinia compressed, with the extremity broad, but sloping inward, golden yellow, ca. 530 × 330 μm, outer apex obtuse with hyaline banding not reaching pollinium apex; retinaculum minute, rhomboid, the stamens situated on the inner basal parts and enclosing the pistil.

Habitat and ecology. Hoya persicinicoronaria grows in montane tropical rainforest, at altitudes from 200–250 m, as an epiphyte on trees. It is associated with *Taxotrophis aquifolioides* W. C. Ko, *Streblus taxoides* (Roth) Kurz, *Terminalia hainanensis* Exell, *Olea hainanensis* H. L. Li, *Drypetes indica* (Mueller Argoviensis) Pax & K. Hoffmann, *Clausena dentata* Burman f., *Capparis zeylanica* L., and *Renanthera coccinea* Loureiro.

Table 1. Morphological comparison of *Hoya persicinicoronaria*, *H. pottsii*, and *H. liangii*.

Characters	*H. persicinicoronaria*	*H. pottsii*	*H. liangii*
Indumentum	glabrous except for calyx and corolla	glabrous	glabrous except for corolla
Leaf arrangement	alternate, opposite, or whorled	opposite	opposite
Leaflet pattern	simple or ternate	simple	simple
Leaf texture	fleshy	fleshy	fleshy
Leaf shape	elliptic or obovate	ovate-oblong or oblong-lanceolate	obovate or obovate-oblong
Blade apex	rounded, cuspidate, or retuse	acute	obtuse or rounded
Blade base	rounded or cuneate	rounded or subcordate	rounded or subcordate
Blade length	7–10 cm	6–12 cm	4.5–8 cm
Blade width	4–5 cm	3–6 cm	3–5 cm
Leaf venation	lateral veins in 3 to 5 pairs	basal veins trinerved	lateral veins in ca. 4 pairs
Calyx shape	elliptic	deltoid	deltoid
External calyx surface	strigose	glabrous	glabrous
Calyx apex	rounded	acuminate	obtuse
Internal corolla surface	white pilose	white pilose	puberulent
Corolla color	white with peach markings	white with reddish center	creamy white
Corolla diameter	ca. 1.3 cm	ca. 1 cm	ca. 1.2 cm
Distribution	China: Bawangling, Hainan Province	China: Guangdong, Guangxi, Hainan, and Yunnan provinces	China: Hainan Province

Distribution. *Hoya persicinicoronaria* is currently only known from the type collections from a small area in Bawangling, Hainan Province, China. Other species of *Hoya* usually grow at elevations between 200 and 1000 m in Bawangling. Another Chinese endemic, *H. lasiogynostegia* P. T. Li, was recorded 25 years ago from Diaoluashan and Jianfengling, Hainan Province (Li, 1984), and was recently rediscovered in Bawangling, Hainan Province (*S. Y. He 20085121*, CANT).

IUCN Red List category. *Hoya persicinicoronaria* is endemic to Hainan, China. It is found in a disturbed area, and its area of habitat has declined gradually. Our fieldwork indicates that the new species has a total population of approximately 300 mature individuals, with an area of occupancy estimated to be less than 10 km^2. Therefore, according to IUCN Red List criteria (IUCN, 2001), this species should be considered Vulnerable (VU D1+2).

Phenology. The new species was observed to flower from May to August. The fragrance of the fresh flowers is sweet.

Etymology. The specific epithet is derived from the new taxon's peach-colored corona.

Discussion. *Hoya persicinicoronaria* closely resembles *H. pottsii* Traill and *H. liangii* Tsiang, but differs from these species in indumentum, leaf arrangement, leaflet pattern, leaf shape, apex, and size, calyx shape, and corolla color (Table 1).

Paratypes. CHINA. **Hainan:** Bawangling, on tree in montane tropical rainforest, 19°06′N, 109°06′E, 210–220 m, 8 Aug. 2007, *S. Y. He & J. Y. Lin 0708087* (CANT), *0708088* (CANT), 12 May 2008, *S. Y. He 0805121* (CANT).

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Gonolobus spiranthus (Apocynaceae, Asclepiadoideae), una Nueva Especie de la Vertiente del Pacífico Mexicano

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Resumen. Recientes estudios de Asclepiadoideae (Apocynaceae) del sur y oeste de México permitió el descubrimiento de un nuevo taxón que se describe e ilustra como *Gonolobus spiranthus* Juárez-Jaimes, W. D. Stevens & Lozada-Pérez. Se caracteriza por tener un ginostegio conspicuamente estipitado, una corola tubular de más de 12 mm de largo e inflada en la base, los lóbulos de la corola fuertemente espiralados, y apéndices dorsales de las anteras triangular-sagitados y carnosos. La ausencia de un anillo faucial en la corola la incluye en el subgénero *Pseudolachnostoma* Woodson.

Abstract. Recent studies of the Asclepiadoideae (Apocynaceae) in southern and western Mexico have revealed a new species here described and illustrated as *Gonolobus spiranthus* Juárez-Jaimes, W. D. Stevens & Lozada-Pérez. This species is distinguished by having a tubular corolla more than 12 mm long that is inflated at the base, strongly spiraled corolla lobes, and dorsal anther appendages that are triangular and sagittate as well as fleshy. The lack of a faucal annulus in the corolla includes it in the subgenus *Pseudolachnostoma* Woodson.

Key words: Apocynaceae, Asclepiadoideae, *Gonolobus*, IUCN Red List, Pacific Mexico, subgen. *Pseudolachnostoma*.

En México, el género *Gonolobus* Michaux se encuentra representado por alrededor de 40 especies (Juárez-Jaimes et al., 2007), esto es un poco menos de un tercio de las especies reconocidas del género. De éstas, alrededor de la mitad son endémicas del país, concentrándose la mayor diversidad en la porción tropical del mismo. Tradicionalmente el género ha sido dividido en tres subgéneros (Woodson, 1941) en función de caracteres asociados a la corola, el ginostegio y el anillo faucial: *Pterolobus* Woodson, *Eugonolobus* Woodson y *Pseudolachnostoma* Woodson. La especie que a continuación se describe se incluye en este último.

Gonolobus spiranthus Juárez-Jaimes, W. D. Stevens & Lozada-Pérez, sp. nov. TIPO: México. Oaxaca: Dpto. Pochutla, Mpio. San Miguel del Puerto, 1.3 km al NE de La Hamaca sobre la brecha a Santa Catarina Jamixtepec, 16°1′26.9″N, 96°3′11.9″W, 465 m, 23 sep. 2001, *A. Saynes 2604* (holotipo, MEXU; isotipo, MO). Figura 1.

Inter species *Gonolobi* subgeneris *Pseudolachnostomatis* Woodson corollae tubo imo inflato lobis torsivis asymmetricis atque antherarum appendicibus dorsalibus triangularibus sagittatis carnosis facillime distinguitur.

Trepadoras leñosas, látex blanco; tallos jóvenes con indumento mixto, más o menos en 2 líneas, tricomas largos multicelulares, reflejos, amarillentos, tricomas cortos glandulares, con ápices rojos. Hojas opuestas, simples, láminas elípticas, 3.5–12 × 2.5–6.2 cm, ápice acuminado a atenuado, base lobada, lóbulos descendentes a convergentes, seno 6–16 mm de profundidad, haz glabra o pubescente con tricomas multicelulares, adpresos, sin tricomas cortos o glandulares, envés glabro o con indumento mixto en los nervios, 4 a 5 pares de nervios laterales, coléteres 2 a 8 en la base del nervio principal; pecíolo 2–7.5 cm, glabro o con indumento mixto en el lado adaxial, los tricomas multicelulares erectos. Inflorescencia extra-axilar, 1 por nudo, congestionado racemiforme, con 1 a 5 flores, pedúnculo 1–10 mm,

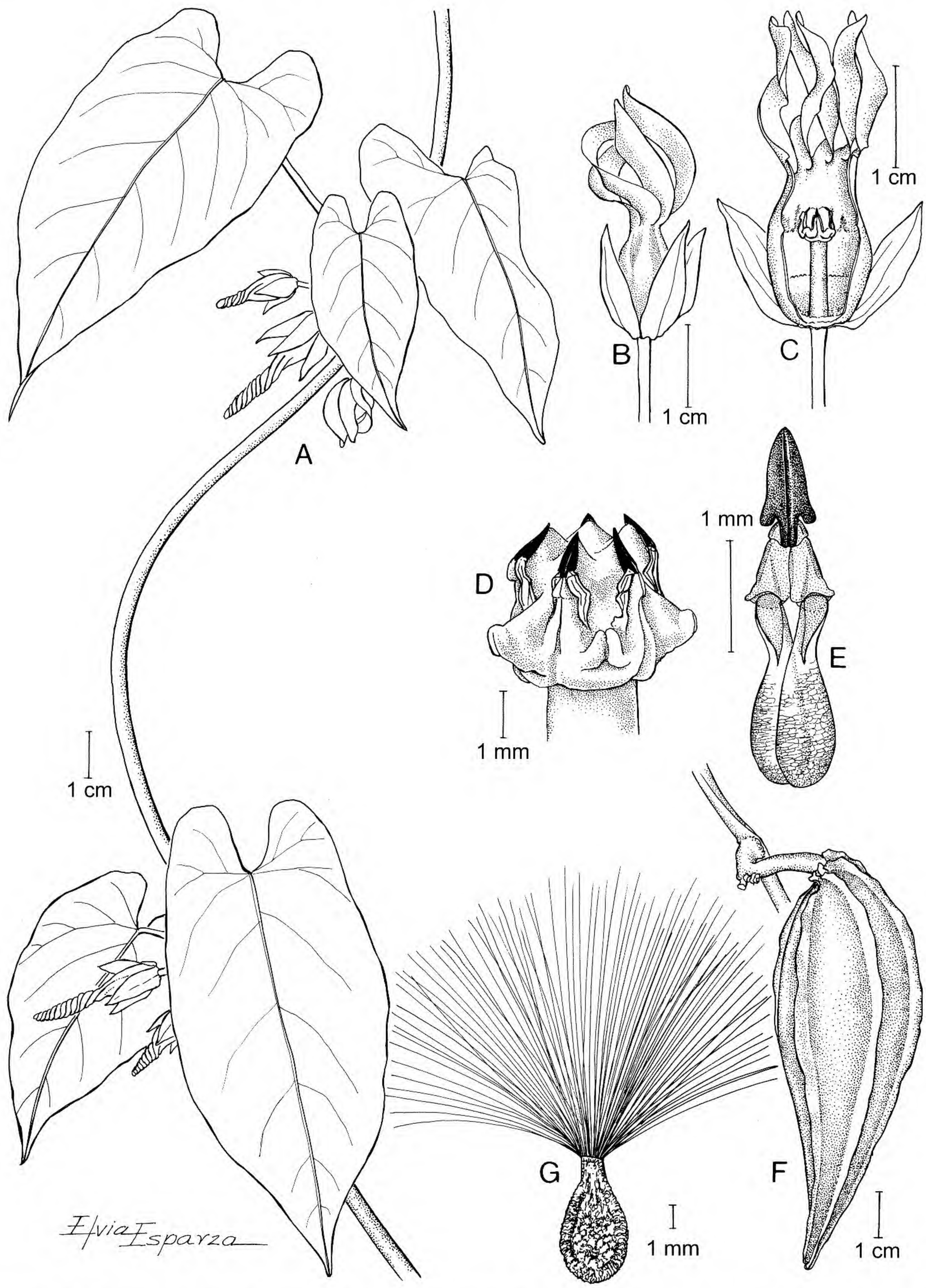

Figura 1. *Gonolobus spiranthus* Juárez-Jaimes, W. D. Stevens & Lozada-Pérez. —A. Rama con flores. —B. Flor. —C. Ginostegio estipitado. —D. Ginostegio. —E. Polinario. —F. Folículo. —G. Semilla. A–E, *Saynes 2604* (MEXU, holotipo); F, G, *Salas et al. 4252* (MEXU).

indumento mixto, tricomas multicelulares adpresos, pedicelo 6–16 mm, indumento mixto, tricomas multicelulares adpresos, brácteas lineares, 2.5–5 mm, adaxialmente glabras, abaxialmente con tricomas multicelulares adpresos. Cáliz con 5 lóbulos divididos casi hasta la base, coléteres 1 por seno, lóbulos imbricados, lanceolados, 11–21 × 2.5–6 mm, glabros en ambas superficies, margen esparcidamente pu-

bescente hacia el ápice, tricomas multicelulares adpresos, ápices agudos; corola tubular con la base inflada, la parte más estrecha ligeramente cóncavo-alargada por abajo de la unión de los lóbulos, amarillo-verdosa, tubo 12–20 mm, glabro por fuera, adentro glabro excepto con tricomas unicelulares, amarillos a rojos, rígidos, patentes, 0.5–0.7 mm, dispuestos en un anillo a nivel del ginostegio, y en forma de 5 triángulos opuestos a los lóbulos de la corola; anillo faucial ausente, lóbulos de la corola falcados, 15–20(–30) × 2.3–4(–7) mm, glabros, ápice obtuso, dextrorsos y espiralados en prefloración, margen derecho prolongado internamente ca. 6 mm; ginostegio conspicuamente estipitado, estípite cilíndrico, acostillado, 5.2–8 mm, ligeramente ensanchado en la base, corona ginostegial en forma de copa, membranácea, adnada a la base del ginostegio y completamente unida a la corola, 2.2–4 mm, crenulada, apéndices dorsales de las anteras 1–1.3 mm, triangular-sagitados, carnosos, apéndices terminales de las anteras ovados, 0.8–1.5 × 0.8–1.2 mm, ápices obtusos, reclinados sobre el ápice del estilo, corpúsculos sagitados, 1.05–1.15 × 0.35–0.48 mm, café-obscuros, caudículas planas o algo enrolladas, 0.7–0.75 × 0.2–0.3 mm, polinios péndulos, ovoides, 1.3–2.08 × 0.47–0.58 mm, excavados y translúcidos cerca del ápice; ápice del estilo profundamente cóncavo. Folículos ovoides, ca. 9 × 3 cm, base oblicua, ápice agudo, con 5 alas onduladas, glabros; semillas obovadas, 4.8–5.2 × 2.5–3 mm, irregularmente crenuladas distalmente, superficie reticulada, coma blanco, 1–4 cm.

Hábitat. *Gonolobus spiranthus* se distribuye en la vertiente del Océano Pacífico en selvas medianas subcaducifolias y vegetación secundaria asociada, en los estados de Jalisco, Michoacán y Oaxaca, México, en altitudes que van de 220 a 1500 m. El espécimen de Malinaltepec en el estado de Guerrero fue recolectado en un huerto familiar, pues de esta planta se consumen las hojas tiernas como quelite, y posiblemente fue extraído en otra localidad de la región.

Categoria de la Lista Roja de la UICN. *Gonolobus spiranthus*, utilizando el criterio de la UICN (2001), es estimado como En Peligro (EN B1+2a) pues la extensión de la presencia estimada es menor de 500 km^2 y severamente fragmentada.

Fenología. *Gonolobus spiranthus* florece de junio a septiembre y fructifica en octubre.

Discusión. Esta especie se relaciona con *Gonolobus albiflorus* W. D. Stevens (Stevens, 2005) por compartir corolas tubulares sin anillo faucial, corolas constreñidas, coronas que no cubren completamente el interior del tubo de la corola y ginostegios con largos estípites, pero en *G. spiranthus* la corola es más grande e inflada en la base, con el tubo de 12–20 mm, con los lóbulos falcados y fuertemente espiralados, y los apéndices dorsales de las anteras triangular-sagitados, a diferencia de *G. albiflorus* que tiene corola uniformemente tubular, con el tubo de 6–8.8 mm y los apéndices dorsales de las anteras espatulados y cóncavos por arriba. Los caracteres que comparten ambas especies, además de los frutos con 5 alas onduladas, también las relacionan con *G. arizonicus* (A. Gray) Woodson y *G. gonoloboides* (Greenman) Woodson, del subgénero *Pseudolachnostoma* propuesto por Woodson (1941).

Paratipos. MÉXICO. **Guerrero:** Mpio. Malinaltepec, Malinaltepec, *I. Wagenbreth 180* y *684* (MEXU). **Jalisco:** Mpio. El Limón, El Limón, *F. J. Santana 522* (IBUG); Mpio. Casimiro Castillo, Cerro La Petaca, 2 km al SE de Casimiro Castillo, *F. J. Santana 5772* (MEXU, ZEA), *F. J. Santana & B. F. Benz 6387* (ZEA), *F. J. Santana et al. 2769* (WIS); Mpio. Cuautitlán, 1–2 km NE of Cuautitlán, *L. Guzmán & F. J. Santana 755* (ZEA). **Michoacán:** Mpio. Tumbiscatío, 15 km al NO de Arteaga sobre camino a Tumbiscatío, Barranca Honda, *Y. Ramírez-Amezcua & V. W. Steinmann 694* (IEB, MEXU). **Oaxaca:** Dpto. Pochutla, Mpio. San Pedro Chacalapa, Hac. Finca Concordia, vic. of Cafetal Concordia, *C. V. Morton & E. Makrinius 2516* (MO, US); Dpto. Pochutla, Mpio. San Miguel del Puerto, 1.6 km al W de Xadani, 600 m de la terracería que va a San Miguel del Puerto, *A. Saynes, M. Elorza, S. Salas & E. Gamboa 2643* (MEXU); Dpto. Yautepec, Mpio. Santa María Ecatepec, 1.5 km al N de San Miguel Chongo, camino a San Pedro Sosoltepec, *S. Salas, A. Saynes & M. Elorza 4252* (MEXU); Mpio. San Carlos Yautepec, 1 km de la desviación de la Merced del Potrero rumbo a Santa Catarina Jamistepec (Cerro de Oro), *A. Saynes, M. Elorza & S. Salas 3167* (FCME, MEXU, MO); La Hamaca, 580 m E sobre el rio Zimatán, sobre la brecha a Santa Catarina Jamistepec, *N. Velázquez, L. Schibli & M. Elorza 394* (MEXU).

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Estudios en las Apocynaceae Neotropicales XXXVI: Una Nueva Especie de *Lacmellea* (Apocynaceae, Rauvolfioideae) para Colombia

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Resumen. Se describe *Lacmellea abbreviata* J. F. Morales (Apocynaceae, Rauvolfioideae), una nueva especie endémica de Región del Chocó, Colombia. Este nuevo taxón se encuentra relacionado con *L. panamensis* (Woodson) Markgraf, de la que difiere por la forma de sus hojas (ovadas a ovado-elípticas vs. elípticas a angostamente elípticas), inflorescencias con menos flores (1 ó 2 vs. 4 a 12), y corolas con los lóbulos más pequeños (3.5–4 mm vs. 6–11 mm). Se incluye una ilustración, datos de distribución, especímenes examinados y se discuten las especies más relacionadas.

Abstract. *Lacmellea abbreviata* J. F. Morales (Apocynaceae, Rauvolfioideae), a new species from the Chocó region, Colombia, is described and illustrated. This new taxon is related to *L. panamensis* (Woodson) Markgraf, but differs by the leaf shape (ovate to ovate-elliptic vs. elliptic to narrowly elliptic), few-flowered inflorescences (1 or 2 vs. 4 to 12), and shorter corolla lobes (3.5–4 mm vs. 6–11 mm). Distribution, specimens examined, and a discussion of taxonomic affinities are included here for the new species.

Key words: Apocynaceae, Colombia, IUCN Red List, *Lacmellea*, Rauvolfioideae.

Lacmellea H. Karsten (Apocynaceae, Rauvolfioideae) es un género de ca. 22 especies, confinado principalmente a la cuenca amazónica y el norte de Suramérica, con sólo cuatro presentes en Mesoamérica (Morales, 1998, 2007). Este género pertenece a la tribu Willughbeeae (Endress & Bruyns, 2000), con ca. 18 géneros distribuidos principalmente en el Paleotrópico. De los géneros presentes en el Neotrópico, *Lacmellea* puede confundirse con *Couma* Aublet y *Parahancornia* Ducke, pero se separa con facilidad de éstos por sus inflorescencias aglomeradas, reducidas y axilares (vs. extendidas, conspicuas y terminales) y por la presencia ocasional de aguijones en su tronco (vs. ausentes). Otro género algo similar es *Hancornia* Gomes, el cual se puede reconocer por sus hojas con las venas secundarias conspicuas y densamente agrupadas (separadas 1–2 mm) y dispuestas más o menos perpendicularmente al nervio central, así como por su tronco carente de aguijones. Las únicas monografías del género *Lacmellea* disponibles hasta la fecha, son los trabajos de Markgraf (1941) y Monachino (1944), ambas caracterizadas por ser divergentes en el número de especies aceptadas (14 y 18 respectivamente), descripciones en algunos casos incompletas (ante la ausencia de flores o frutos), así como por los pocos especímenes estudiados. En el caso de Markgraf (1941) dos especies fueron reportadas para Colombia, mientras que Monachino (1944) reconoció un total de cuatro taxones en ese país (incluyendo *L. foxii* (Stapf) Markgraf) cuya localidad tipo fue erróneamente reportada en Perú. En la preparación de un tratamiento de la familia Apocynaceae (subfamilias Apocynoideae y Rauvolfioideae) para Colombia, se encontró una nueva especie de *Lacmellea*, la cual es descrita a continuación. Con este nuevo taxón, se eleva a 11 el número actual de especies de ese género presentes en Colombia (Morales, datos sin publ.).

Lacmellea abbreviata J. F. Morales, sp. nov. TIPO: Colombia. Chocó: Quibdó, barrio Obrero, 24 may 1985 (fl., fr.), *J. Espina & F. García 1528* (holotipo, INB; isotipos, CHOCO no visto, HUA). Figura 1.

Haec species *Lacmelleae panamensi* (Woodson) Markgraf, *L. arborescenti* (Müller Argoviensis) Markgraf et *L. eduli* H. Karsten similis, sed a his duabus corollae tubo longiore, ab ultima fructu subgloboso, a prima foliis ovatis vel ovato-ellipticis, inflorescentia 1- vel 2-flora et corollae lobis brevioribus differt.

Árboles 5–12 m de altura, el tronco con espinas, ramitas aplanadas cuando jóvenes, subteretes con la edad, glabras. Hojas con el pecíolo de 3–8 mm, glabro; láminas de 3.5–6(−7.5) × 1–2.7(−3.2) cm, ovadas a ovado-elípticas, el ápice cortamente acuminado, la base obtusa a redondeada, glabras, a veces con puntuaciones negras en la superficie abaxial, no revolutas, venas secundarias separadas por 3–5 mm entre sí. Inflorescencia axilar, con 1 ó 2 flores, glabra, pedúnculo de 3–5 mm, pedicelos de 2.5–5.5 mm, brácteas de 0.5–1 mm, bractéolas 0.8–1.4 mm. Sépa-

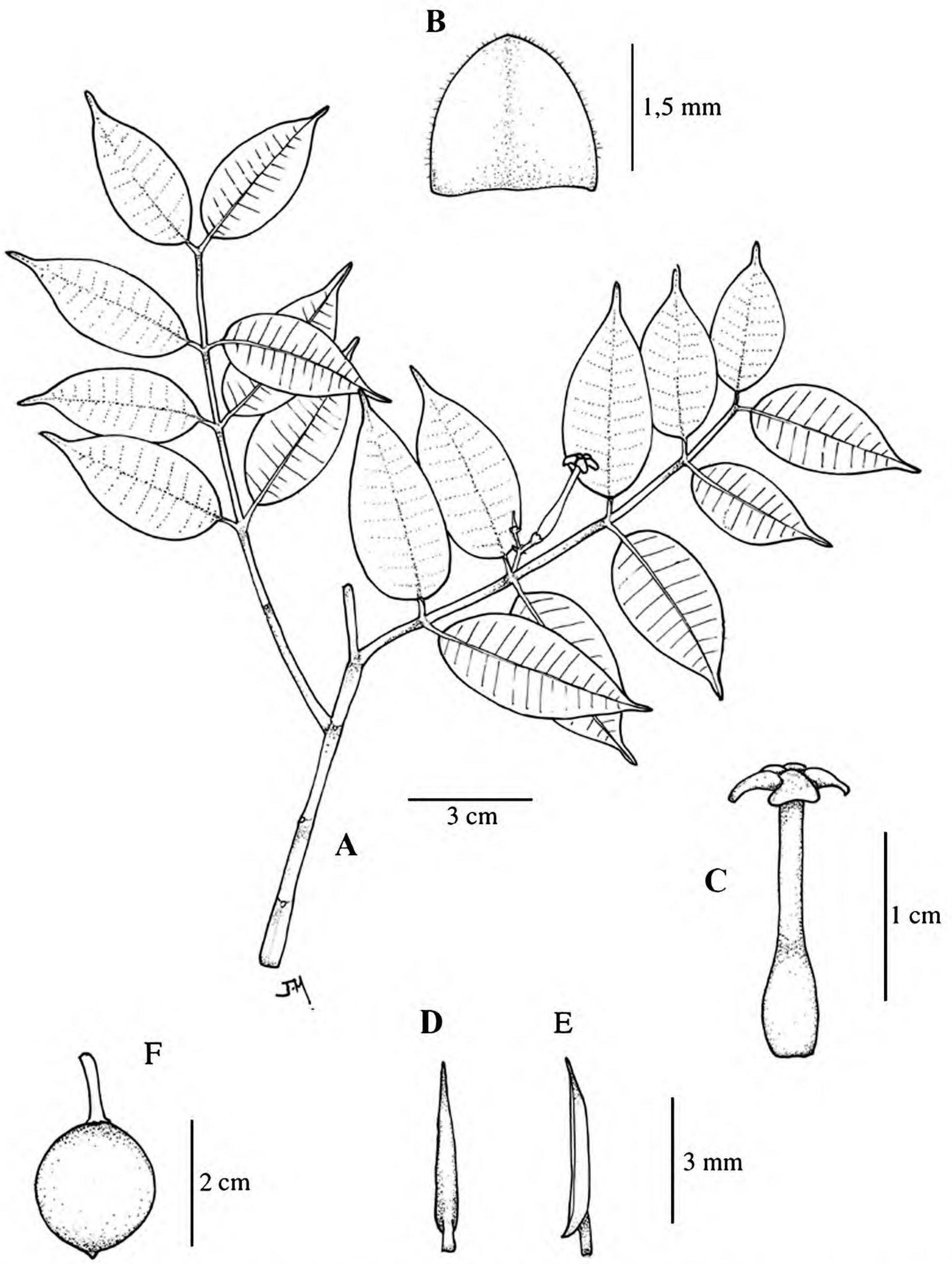

Figura 1. *Lacmellea abbreviata* J. F. Morales. —A. Ramita con inflorescencias. —B. Vista de la cara abaxial de un sépalo. —C. Detalle del tubo de la corola. —D. Antera, vista lateral. —E. Antera, vista dorsal. —F. Fruto. Dibujo basado en el holotipo *J. Espina & F. García 1528* (INB).

los 1.1–1.9 × 1.1–1.6 mm, anchamente ovados, el ápice agudo a obtuso, glabrescentes, diminutamente ciliolados marginalmente; corola blanca, la superficie externa y la cara adaxial de los lóbulos inconspicua y esparcidamente puberulenta, la pubescencia del tubo restringida a su región distal, tubo 19–22.5 × 1.5–3 mm, abultado en la base y en la posición de los estambres; lóbulos 3.5–4 × 2–2.5 mm, angostamente ovados; anteras ca. 4 mm, el dorso glabro, cabeza estigmática ca. 2 mm, ovario ca. 1.5 mm. Frutos subglobosos, (1.8–)2–2.4 cm diám., amarillos al madurar.

Distribución, hábitat y fenología. La nueva especie es endémica de los departamentos de Antioquia, Caldas y Chocó en Colombia, donde crece en bosques

muy húmedos y áreas de vegetación secundaria relacionada, en elevaciones de 50–1350 m. Especímenes con flores han sido recolectados en junio y material con frutos se conoce de febrero, abril y junio.

Categoría de la Lista Roja de UICN. *Lacmellea abbreviata* es una especie endémica de Colombia, específicamente al oeste del Departamento de Antioquia (Parque Nacional Natural Las Orquídeas) y el norte del Departamento del Chocó (región de Quibdó), donde se conoce de tres regiones geográficas definidas. De acuerdo a los criterios de la Lista Roja de UICN, el estatus a esta especie puede ser definido como En Peligro (EN), debido a su limitado rango de distribución geográfica y el reducido número de localidades conocidas (UICN, 2001).

Etimología. El nombre de la nueva especie hace referencia al relativo pequeño tamaño de las hojas e inflorescencias.

Discusión. *Lacmellea abbreviata* se puede confundir con *L. panamensis*, pero se separa por sus inflorescencias con menos flores (1 o 2 vs. 4 a 12), corolas con los lóbulos mucho más pequeños (3.5–4 mm vs. 6–11 mm), así como láminas foliares de forma diferente (ovadas a ovado-elípticas vs. elípticas a angostamente elípticas). Esta especie ha sido erróneamente identificada como *L. peruviana*, en la actualidad un sinónimo de *L. arborescens* (Müller Argoviensis) Markgraf, de la que se puede separar por sus flores con el tubo de la corola más largo (19–22.5 mm vs. 11–14 mm). *Lacmellea edulis* es otra especie presente en Colombia que se puede confundir con *L. abbreviata*, pero ambas se pueden separar con facilidad por el tamaño de la corola y forma de los frutos, ya que en *L. edulis* el tubo de la corola tiene una longitud entre 14–17 mm y los frutos son elipsoides, mientras que en *L. abbreviata* el tubo varia entre 19–22.5 mm de longitud y los frutos son subglobosos.

Paratipos. COLOMBIA. **Antioquia:** Parque Nacional Natural Las Orquídeas, Río Calles, 2 jun. 1988, *A. Cogollo & J. Ramírez 3178* (COL, JAUM, MO); Planta Providencia, Valle del Río Anorí, 10 feb. 1975, *J. Denslow 2696* (COL, HUA, MO). **Caldas:** Samaná, Florencia, 4 oct. 1990, *G. Mahecha et al. 7116* (UDBC). **Chocó:** Quibdó, vía Quibdó–Yuto, hacia el Real de Tatando, 29 jun. 1983, *E. Forero, R. Jaramillo, J. Espina & L. Quiñones 9587* (COL, MO); Quibdó, vía Yuto–Lloró, 30 jun. 1983, *E. Forero, R. Jaramillo, J. Espina & L. Quiñones 9643* (COL, MO); Tubadó, entre Quibdó y Tutunendo, 17 ene. 1979, *A. Gentry & E. Rentería 24325* (HUA, MO); Quibdó–Tutunendo, al O de Tutunendo, 5 ene. 1981, *A. Gentry, M. Mulanpy, N. Hikes, S. Libenson, M. Olson & A. Cogollo 30119* (JAUM, MO), 7 ene. 1981, *A. Gentry, M. Mulanpy, N. Hikes, S. Libenson, M. Olson & A. Cogollo 30277* (INB, JAUM, MO); camino a Lloró, al S de Yuto, 13 jun. 1982, *A. Gentry & J. Brand 36853* (JAUM, MO, WAG); camino a Lloró, Quibdó–Istmina, 15 jun. 1982, *A. Gentry & J. Brand 36976* (JAUM, MO), 17 jun. 1982, *A. Gentry, L. Escobar & J. Brand 37024* (MO); Quibdó, corregimiento Guayabal, Río Hugón, 21 abr. 1982, *M. Sánchez 295* (MEDEL).

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A New Species of *Taxiphyllum* (Musci: Hypnaceae) from Sri Lanka

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Abstract. A new species, *Taxiphyllum townsendii* Ochyra & Ireland (Hypnaceae, Musci), is described from Sri Lanka. The species was earlier known under the name *Plagiothecium ceylonense* Brotherus ex Dixon, but this name was not validly published and therefore a new name is needed. *Taxiphyllum townsendii* is similar in many ways to the common eastern North American species, *T. deplanatum* (Bruch & Schimper ex Sullivant) M. Fleischer, but differs by its larger, often oblong-lanceolate leaves that are abruptly or gradually short- or long-acuminate; much longer and narrower mid-leaf cells; short-rectangular, very broad basal leaf cells that form a distinct 1- to 2-seriate strip at the leaf insertion; and a prominent angular group of large quadrate to short-rectangular cells that extend up the margins by four to 10 cells. *Taxiphyllum subretusum* (Thwaites & Mitten) O'Shea is transferred to the genus *Phyllodon* Schimper as *P. subretusus* (Thwaites & Mitten) Ochyra & Ireland and the name is lectotypified. The validity of the name *Entodon isopterygioides* (Dixon) Dixon is discussed and this name is considered to be validly published.

Key words: Asia, *Entodon*, Hypnaceae, *Phyllodon*, Sri Lanka, *Taxiphyllum*.

While studying the genus *Plagiothecium* Schimper in Africa, the first author obtained from Clifford C. Townsend (K) two specimens of a moss collected in 1973 in Sri Lanka, which superficially resembled members of that genus. Two species of *Plagiothecium* have hitherto been recorded from Sri Lanka: *P. subglaucum* Thwaites & Mitten and *P. ceylonense* Brotherus ex Dixon (Abeywickrama & Jansen, 1978; O'Shea, 2002). The former is conspecific with *P. neckeroideum* Schimper. The specimens supplied by Townsend proved to be different from this species, but they clearly match the original collection of *P. ceylonense*.

The name *Plagiothecium ceylonense* was used by Brotherus on the herbarium label of a plant collected in October 1901 by Robert Wright (*Wright 3798*) and distributed in "Bryotheca E. Levier." However, there was no description on the label, nor was this species name mentioned for the Musci in either edition of *Die natürlichen Pflanzenfamilien* (Brotherus, 1908, 1925). This name was subsequently used by Dixon (1915) for five specimens of mosses collected in 1913 by C. H. Binstead on Ceylon. The compilers of *Index Muscorum* (Wijk et al., 1967) considered the name *P. ceylonense* to have been validated in Dixon (1915). However, careful analysis of the entry dealing with this species indicates the name was not validly published. This text (Dixon, 1915: 294) states: "*Plagiothecium ceylonense* Broth. ined. Rock in stream, deeply shaded, near Hagkala (222), det. Brotherus; by stream, &c., N. E. (353, 359, 369); shaded rock near stream, Nanuoya (424), a robust form with stems 4 in. long, and leaves less denser and less complanate than usual."

Some early botanists used "form" as a term similar to the modern term "taxon," so that the "robust form" would be the species itself, but here it seems clear that it only represents number 424 from Nanuoya that is a "robust form." Therefore, we believe that the brief description in Dixon (1915) applies only to the [unnamed] variant (forma?) that the *Binstead 424* specimen represents. In his 1915 paper, Dixon described seven new species jointly with Brotherus (*Fissidens aberrans* Brotherus & Dixon, *Macromitrium assimile* Brotherus & Dixon, *Bryum ceylonense* Brotherus & Dixon, *Camptochaete thamnioides* Brotherus & Dixon, *Acanthocladium ceylonense* Brotherus & Dixon, *Taxithelium binsteadii* Brotherus & Dixon, and *Vesicularia caloblasta* Brotherus & Dixon), and from this it seems clear Dixon had no intention of validating Brotherus' manuscript name.

After examining the original Wright material of *Plagiothecium ceylonense*, the Binstead specimens reported by Dixon (1915), as well as the two recent Townsend collections, we conclude that they all represent a single distinct species of *Taxiphyllum* M. Fleischer, instead of *Plagiothecium*, based on the

revised generic concept of *Taxiphyllum* and *Plagiothecium* proposed by Iwatsuki (1963, 1970) and Robinson (1974). These two genera share a complanate-foliate habit and a short, double costa, which prompted some authors to keep them together in the family Plagiotheciaceae (e.g., Szafran, 1961; Nyholm, 1965; Lawton, 1971; Smith, 1978; Noguchi, 1994), while Grout (1932) merged them and considered *Taxiphyllum* a subgenus of *Plagiothecium*. However, except for a similar habit and costa, *Taxiphyllum* has little else in common with *Plagiothecium* and the Plagiotheciaceae as defined by Buck and Ireland (1985). The lack of a differentiated stem epidermis, nondecurrent leaves, and presence of foliose pseudoparaphyllia preclude the new species from inclusion in *Plagiothecium*. On the other hand, these features suggest its relationship lies with the Hypnaceae, in *Taxiphyllum* as Fleischer (1923) originally proposed when establishing that genus. This family placement of *Taxiphyllum* has recently gained wider acceptance by various bryologists (e.g., Iwatsuki, 1963; Crum & Anderson, 1981; Buck, 1998; Ochyra et al., 2003; Zhang & He, 2005).

Taxiphyllum townsendii Ochyra & Ireland, sp. nov. TYPE: Sri Lanka. Central Prov.: Nuwara Eliya Distr., on rocks in ravine of Nanu Oya, just outside Nuwara Eliya, 17 Mar. 1973, *C. C. Townsend 73/1393* (holotype, E; isotype, KRAM). Figure 1.

Plagiothecium ceylonense Brotherus ex Dixon, J. Bot. 53: 294. 1915, nom. ined. "Plagiothecium ceylonense Broth. ms. nov. sp. (in lit. 1902) [Sri Lanka] Insula Ceylon S. W. Hinidoon–Kanda Hills (0–2200 ft.), Oct. 1901, legit Robert Wright, determ. V. F. Brotherus n° 3798."

Species haec *Taxiphyllo deplanato* (Bruch & Schimper ex Sullivant) M. Fleischer similis, sed ab eo foliis longioribus plerumque oblongo-lanceolatis et cellulis in medio laminae longioribus angustioribusque, basi brevioribus dilatatisque 1- vel 2-seriatis, margine cellulis angularibus majoribus 3- ad 5-seriatis quadratis vel oblatis alam distinctam formantibus facillime distinguitur.

Plants medium-sized to fairly large, soft, forming extensive, thin or dense mats, lustrous, pale green to yellow-green, becoming brownish green with age; stems creeping, to 6 or occasionally 10 cm, irregularly branched, mostly complanate-foliate or occasionally terete, not or sparsely radiculose ventrally with scattered fascicles of light brown, smooth, unbranched rhizoids, transverse section rounded to elliptical, consisting of (1 to)2(to 3) rows of smaller cortical cells with yellow, thickened walls, surrounding 2 to 3 rows of enlarged, thin-walled, hyaline medullary cells; central strand small and distinct or indistinct, sometimes absent; pseudoparaphyllia foliose, triangular; axillary hairs sparse, filiform, with 1 or 2 short, brownish basal cells and a single, elongate, hyaline distal cell. Stem and branch leaves similar, the stem leaves sometimes only somewhat larger, not or little changed and somewhat shrivelled when dry, slightly distant to close and overlapping, wide- or erect-spreading to imbricate, complanate and appearing distichous, but arranged in more than 2 rows, nondecurrent, smooth, straight, symmetric, concave, 1.8–2.1 × 0.5–0.9 mm (width near leaf middle), becoming somewhat narrowed to the insertion, oblong- to ovate-lanceolate or lanceolate, usually abruptly narrowed to an acute, broad, or filiform apex of varying length or, less often, gradually slenderly long-acuminate; margins plane, sharply serrate or serrulate distally, remotely and weakly serrulate to nearly smooth in the proximal part; costa faint, short and double, usually with 1 branch longer, or often lacking; laminal cells smooth or minutely prorulose at both ends on adaxial surface, thin-walled, nonporose, linear-flexuose, with sharp, long-acuminate tips, 80–140 × 5–7 μm (width at mid-leaf), becoming somewhat shorter and wider, oblong-hexagonal near leaf apex and 40–70 × 7–10 μm at leaf base; alar cells quadrate, oblate, or some short-rectangular, 15–20 × 15–25 μm, thin- to somewhat firm-walled, arranged in 3 to 5 rows, forming a prominent group extending up the margins by 4 to 10 cells; cells at the insertion hexagonal to oblong, 30–50 × 15–20 μm, thin-walled, forming distinct 1- to 2-seriate strips at the leaf base, sharply demarcated from the adjacent laminal cells. Sex organs and sporophytes unknown.

Habitat and distribution. *Taxiphyllum townsendii* is an epilithic moss growing on shaded rocks by and in streams and waterfalls. The species is endemic to Sri Lanka, where it occurs in the mountainous region in the south-central part of the island.

IUCN Red List category. No additional information on biology and size of the populations of *Taxiphyllum townsendii* is available. Therefore, the species is included in the category Data Deficient (DD) according to IUCN Red List categories and criteria (IUCN, 2001). However, the discovery of the species at several sites may indicate that it is not rare in the region.

Etymology. This species is named in honor of Clifford C. Townsend (1926–), the eminent British bryologist who rediscovered it in Sri Lanka and has contributed much to the knowledge of the taxonomy and distribution of mosses in various parts of the globe.

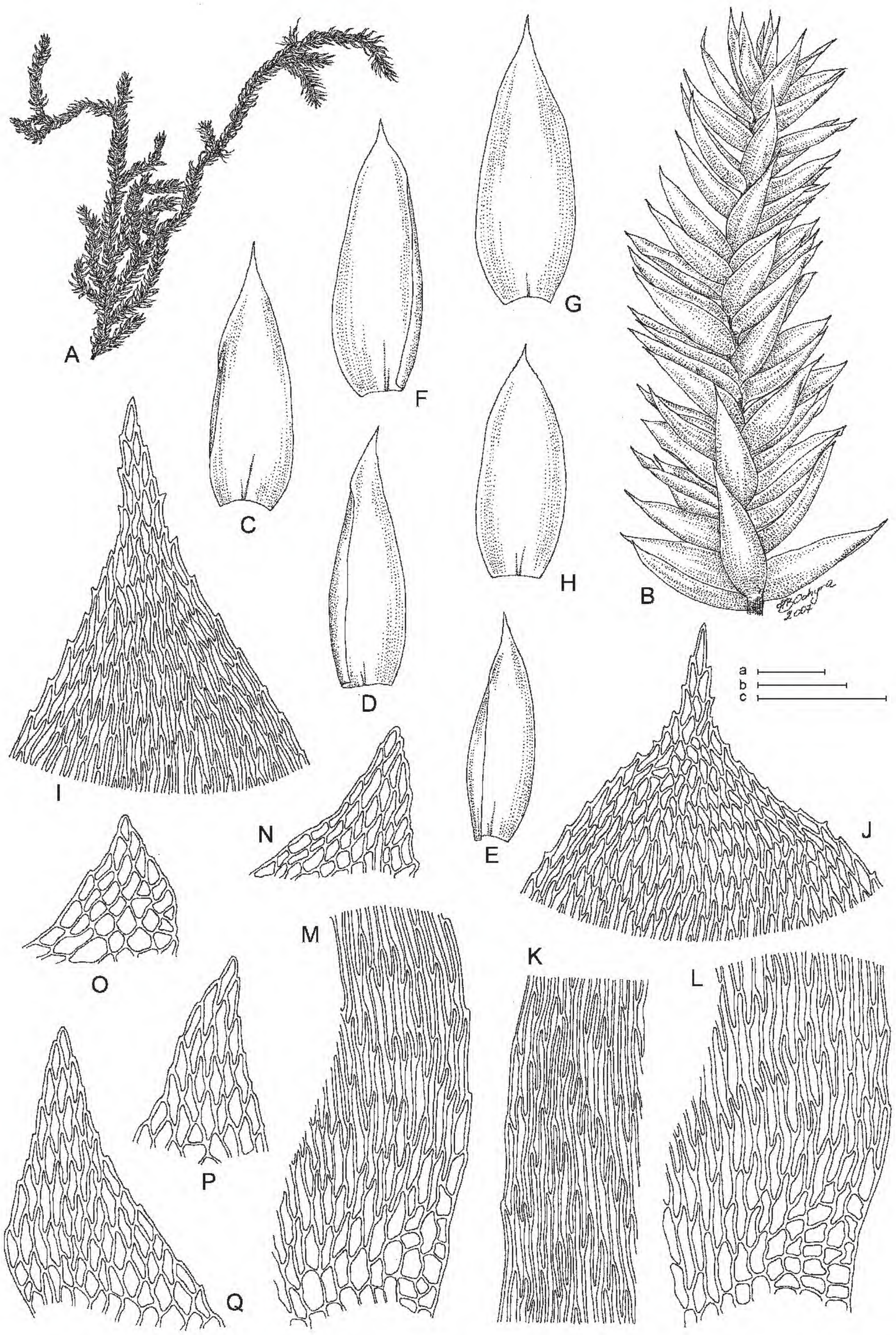

Figure 1. *Taxiphyllum townsendii* Ochyra & Ireland. —A. Habit, dry. —B. Portion of branch, moist. —C–H. Leaves. —I, J. Leaf apices. —K. Mid-leaf cells at margin. —L, M. Angular cells. —N–Q. Pseudoparaphyllia. A, F–H, J, L, N, O drawn from the paratype (*Wright 3798*, KRAM); B–E, I, K, M, P, Q drawn from the isotype (*Townsend 73/1393*, KRAM). Scale bars: a = 1 mm (B); b = 1 cm (A); c = 1 mm (C–H) and 100 μm (I–Q).

Discussion. *Taxiphyllum townsendii* is recognized from its congeners by its leaf areolation. The mid-leaf cells are linear-flexuose, 80–140 × 5–7 μm, and the alar region forms a prominent group of large, mostly quadrate cells, 15–20 × 15–25 μm, with four to 10 cells extending upward along the margins. In addition, the basal leaf cells differ markedly from the adjacent laminal cells, being much shorter and wider, hexagonal to oblong, 30–50 × 15–20 μm, and forming a distinct strip along the leaf insertion composed of one or two rows of cells. As is the case with the majority of *Taxiphyllum* species, its stems are complanate-foliate. Occasionally the branches are terete-foliate.

Taxiphyllum townsendii is one of the largest species of the genus, with plants as long as 10 cm. In Asia, *Taxiphyllum* is represented by about eight species, some of which have not yet been critically evaluated. Five distinct and well-defined species are known from Japan (Noguchi, 1994) and mainland Asia (Zhang & He, 2005), but none match *T. townsendii* in morphological and anatomical characters. *Taxiphyllum arcuatum* (Bosch & Sande Lacoste) S. He, *T. alternans* (Cardot) Z. Iwatsuki, and *T. taxirameum* (Mitten) M. Fleischer are morphologically different from *T. townsendii* in having poorly differentiated alar cells. *Taxiphyllum cuspidifolium* (Cardot) Z. Iwatsuki has prominent alar cells, but the distinctly julaceous habit and shorter and wider laminal cells (80–100 × 7–9 μm) make it very distinct from all other congeners, including *T. townsendii*. The fifth species, *T. aomoriense* (Bescherelle) Z. Iwatsuki, is a strongly complanate moss with markedly distichous leaves and apices turned down toward the substratum. This characteristic habit, coupled with its much shorter cells (65–85 × 6–7 μm), differentiates it from *T. townsendii*. The other two continental species, *T. inundatum* Reimers and *T. giraldii* (Müller Hallensis) M. Fleischer, are poorly known taxa that have no differentiated alar cells or only poorly developed ones; they appear to be closely related to *T. taxirameum*. The Malaysian *T. punctulatum* M. Fleischer is described by Fleischer (1923) as having very small leaves, 0.7–0.8 × 0.3 mm, with very short, narrow laminal cells, 30–40 × 4–5 μm. Finally, *T. maniae* (Renauld & Paris) M. Fleischer, which is known from India, Malaysia, and New Guinea, is conspecific with *T. taxirameum* (O'Shea et al., 2003).

Taxiphyllum townsendii seems to be most similar to *T. deplanatum* (Bruch & Schimper ex Sullivant) M. Fleischer, primarily an eastern and southwestern North American plant (Ireland, 1969) that is also known from Mexico and Honduras (Ireland & Buck, 2009). The two species share a similar leaf shape, although *T. deplanatum* generally has shorter leaves, averaging 1.3–1.7 mm long. Its plants are usually complanate with the leaves arranged in two rows, giving them a characteristic appearance of being regularly plaited or braided with apices turned slightly downward. This species is very distinct from *T. townsendii* in its shorter, wider mid-leaf cells that are 50–90 × 5–12 μm, possessing a smaller alar group with smaller cells at the leaf insertion.

Paratypes. SRI LANKA. **Central Prov.:** near Hagkala, rocks in stream, deeply shaded, 1 Mar. 1913, *C. H. Binstead 222* (BM); Nanuoya, shaded rocks near stream, 13 Mar. 1913, *C. H. Binstead 424* (BM); Nuwara Eliya, by stream, 1913, *C. H. Binstead 353* (BM); Nuwara Eliya, rock near waterfall, Feb. 1913, *C. H. Binstead 359* (BM); Nuwara Eliya, on rocks below waterfall above Grand Hotel, 19 Mar. 1973, *C. C. Townsend 73/1556* (E, KRAM, US); Hinidoon, Kanda Hills, Oct. 1901, *Wright 3798* (BM, H-BR, KRAM, PC).

Taxonomic notes. There are three other species of *Taxiphyllum* known from Sri Lanka (O'Shea, 2002): *T. taxirameum* (Mitten) M. Fleischer, *T. subretusum* (Thwaites & Mitten) O'Shea, and *T. isopterygioides* (Dixon) W. R. Buck. The leaf areolation readily separates *T. townsendii* from *T. taxirameum*, a pantropical and subtropical species that is common and widely distributed in Asia. The median leaf cells are variable in *T. taxirameum*, ranging in length from 40–125 μm, but they average only 50–70 μm, and are usually prorate and shortly acute, rounded, slanted, or truncate at both ends rather than smooth, sharp, and long-acuminate. The alar cells are only slightly differentiated and form a small group composed of one to three rows, with only one to five cells in the marginal row, and the cells at the leaf insertion are not markedly larger from the laminal cells above the base. In addition, the leaves are rigid, not or only somewhat overlapping, and usually far apart rather than being soft, close, and overlapping.

The other two Sri Lankan species, *Taxiphyllum subretusum* and *T. isopterygioides*, actually do not belong within *Taxiphyllum*. *Taxiphyllum subretusum* has ligulate leaves that are broadly obtuse and coarsely, often doubly, dentate at the apex with margins above mid-leaf having distinctly prorate distal cells and lacking differentiated alar cells. These features are all typical of the genus *Phyllodon* Schimper and accordingly this species is transferred to that genus.

Phyllodon subretusus (Thwaites & Mitten) Ochyra & Ireland, comb. nov. Basionym: *Ectropothecium subretusum* Thwaites & Mitten, J. Linn. Soc., Bot. 13: 321. 1873. *Taxiphyllum subretusum* (Thwaites & Mitten) O'Shea, J. Hattori Bot. Lab. 92: 126. 2002. TYPE: [Sri Lanka.] "Ins. Ceylon, [s.d.], *Dr. Thwaites* [246 in sched., NY]" (lectotype, designated here, NY-Mitten 780336;

isotypes, "Ectrop. subretusum C. M. 246 Ambagamara, Centr. Prov., Ceylon 300 ft.," BM 662671, BM 662672, BM 662673).

It should be noted that such a relationship of this species was first suggested by Fleischer (1923) and later Tixier (1988) when they placed it in the genus *Glossadelphus* M. Fleischer, which is congeneric with *Phyllodon* (Buck, 1987).

Taxiphyllum isopterygioides has a very complanate habit and broadly ovate, ecostate leaves that are broadly rounded-obtuse to broadly acute at the apex, serrate in the distal part, and distinctly constricted at the base, with numerous large, subhyaline cells at the base forming a prominent alar group. These features suggest this species belongs to *Entodon* Müller Hallensis. This species was originally described as *Taxithelium isopterygioides* Dixon (Dixon, 1915), and it was subsequently transferred to *Entodon* by Dixon (1933). The compilers of *Index Muscorum* (Wijk et al., 1962) treated *E. isopterygioides* as a nomen nudum, but they overlooked the parenthetical author citation "Dix." in Dixon's (1933: 27) paper, and this represents an indirect reference to the basionym, *Taxithelium isopterygioides*. Therefore, *E. isopterygioides* (Dixon) Dixon should be considered a validly published name.

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Validation of the Hybrid Flowering Cherry *Prunus* ×*incam* (Rosaceae)

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Abstract. The name *Prunus* ×*incam* Ingram ex R. Olsen & Whittemore is validated here. Introduced as a cultivated variety in 1947, Ingram's name *Prunus* ×*incam* has been in use as a nomen nudum in horticultural literature and the nursery trade for artificial crosses involving the parent taxa *P. incisa* Thunberg × *P. campanulata* Maximowicz. *Prunus* ×*incam* is an early flowering tree with two or three flowers in each persistent involucre, spreading sepals, and pink, deeply emarginate petals. Ingram's original introduction, the cultivated variety 'Okamé,' is the most widely grown form.

Key words: Okamé cherry, *Prunus*, Rosaceae.

Prunus L. (Rosaceae Jussieu), with some 200 species, is a ubiquitous component of the cultivated flora in temperate zones, including species that are important as fruit, nut, and ornamental crops. The most important group of ornamentals in the genus are the flowering cherries of *Prunus* subg. *Cerasus* (Miller) Focke sect. *Pseudocerasus* Koehne, a group of small trees from eastern Asia with very showy white or pink flowers (Rehder, 1940).

The Chinese species *Prunus campanulata* Maximowicz historically has attracted the attention of horticulturists because of its early flowering (early to mid-March) and the striking deep pink coloration of its petals. However, *P. campanulata* is a species of southern China, Taiwan, and possibly also the Ryukyu Islands of Japan, although the species may have been introduced here by man (Ohwi et al., 1984; Li & Bartholomew, 2003). Its use in temperate climates is limited by its sensitivity to winter cold, since it can only be relied upon to survive winters in U.S. Department of Agriculture (USDA) hardiness zones 8 (annual minimum temperatures above −12°C) and warmer (Cathey, 1990).

Plants combining desirable characteristics of *Prunus campanulata* with greater cold tolerance have been produced by crossing *P. campanulata* with *P. incisa* Thunberg, the Fuji cherry, a more cold-tolerant species. *Prunus incisa* is native to Japan in central Honshu on the slopes of Mt. Fuji, Mt. Hakone, and Mt. Yatsu, and through the Southern Alps (Flower Association of Japan, 1982; Ohwi et al., 1984). It is one of the alpine cherries surviving to zone 5 (−28°C) that flowers in early April in the north temperate zone (Ingram, 1948; Dirr, 1998; Kuitert & Peterse, 1999). The hybrid was first produced ca. 1942 by English breeder Collingwood Ingram, who pollinated *P. incisa* stigmas with pollen collected from *P. campanulata* growing in the temperate house of the Royal Botanic Gardens, Kew (Ingram, 1942, 1948, 1970).

Ingram presented his best *Prunus incisa* × *P. campanulata* hybrid to the Royal Horticultural Society on April 15, 1947, reported first as *P. incisa* × *campanulata* var. Okamé by the *Gardeners' Chronicle* (1947), but recorded by the Royal Horticultural Society, which conferred the plant an Award of Merit as *Prunus* × *Incam* var. 'Okamé' (Royal Horticultural Society, 1947a, b). The cultivar, and hybrid epithet, quickly became established in the British horticultural trade, receiving an Award of Garden Merit from the Royal Horticultural Society for its outstanding performance in British gardens only seven years after introduction (Fletcher, 1954). The plant was introduced to the United States before its public release, when American horticulturist Henry Skinner brought plants directly from Ingram's garden to the Morris Arboretum, University of Pennsylvania, in 1946 (Meyer & Lewandowski, 1985). Further introductions into the United States and other countries have made this plant widely available in the international horticultural trade. Currently, *P.* ×*incam* 'Okamé' is a popular, widely used cultivar in temperate areas throughout the world with annual minimum temperatures above −23°C (USDA hardiness zone 6). Recently, additional *P.* ×*incam* cultivars (e.g., 'Dream Catcher' and 'First Lady') have entered the trade (Pooler, 2007).

Although the name *Prunus* ×*incam* is used widely in horticultural literature, nursery catalogs, and other garden-related publications, this binominal has never been validly published. Some publications (e.g., Huxley & Griffiths, 1992) dropped the epithet, using only the cultivar name with the genus (e.g., *Prunus* 'Okamé'), but this has not slowed the use of the epithet in the nursery trade. The introduction of a variant spelling, *Prunus* ×*incamp*, in England by Boddy (1964) and its use by the Flower Association of Japan (1982) and a few American horticulturists (Dirr, 1998, 2000) has introduced further confusion, with both spellings currently used commonly in the trade.

Figure 1. *Prunus* ×*incam* Ingram ex R. Olsen & Whittemore. Flowering and fruiting branches. Drawn by R. Olsen from living material of *P.* ×*incam* 'Okamé' (NA 18355-CL) at the U.S. National Arboretum.

In view of the continued widespread use of *Prunus* ×*incam*, and in view of the growing confusion caused by the existence of two well-established variant spellings, it seems appropriate to stabilize the name and its usage by formally publishing it and assigning a type specimen.

Prunus ×**incam** Ingram ex R. Olsen & Whittemore, nothosp. nov. [♀ *Prunus incisa* Thunberg × ♂ *Prunus campanulata* Maximowicz]. TYPE: U.S.A. Washington, D.C.: United States National Arboretum, N side of Crabapple Collection, E of Beechwood Pond, planted tree in mowed meadow, accession NA 18355-CL, 38°54′37″N, 76°57′38″W, 6 m, 22 Mar. 2007, *A. T. Whittemore & R. Olsen 07-002* (holotype, NA; isotypes, A, K, MO, MOR, TUS). Figure 1.

Arbor praecox; ramuli hornotini glabri; gemmae 1 ad 3 in quaque axilla. Folia margine argute serrata. Flores 2 ad 3

involucro communi cincti. Sepala patula, 2–3 mm longa; petala carnea, emarginata, ca. 9 mm longa.

Deciduous trees to 8 m tall; bark silvery gray, smooth except for prominent transverse lenticels; young shoots glabrous; buds 1 to 3 per axil; stipules caducous. Petiole 7–12 mm, upper surface villous; glands none or 1 at summit of petiole; leaf blade narrowly obovate or oblanceolate, 47–70 × 22–31 mm, dark green, with 7 to 9 major veins on each side of the midrib, glabrous except for a few inconspicuous villous hairs on both surfaces of major veins and leaf margin, apex slenderly acuminate, base obtuse (seldom acute) or rounded, margins sharply serrate. Inflorescence appearing before expansion of leaves, of 2 or 3 flowers on 3–13 mm pedicels, common peduncle absent or to 3 mm; bracts to 5 mm, several around base of inflorescence, outer bracts brown and scalelike, forming an involucre, inner bracts green, obovate, strongly toothed; involucre persistent in flower. Flower with petals pink, hypanthium and sepals red; hypanthium cylindrical, 5–8 × 2–3 mm, glabrous; sepals triangular, 2–3 × 1.5–2 mm, entire and glabrous, shorter than hypanthium and spreading perpendicular to it; petals oblong to obovate, deeply emarginate, ca. 9 × 4–6 mm; stamens 4–7 mm, anthers plump, pollen copious and well-formed; style projecting 6–11 mm beyond hypanthium. Fruit not seen, rarely produced.

Discussion. The type specimen came from a plant of *Prunus* ×*incam* 'Okamé' (NA 18355-CL) at the U.S. National Arboretum that traces back, via the Washington Park Arboretum in Seattle, Washington, to the original distribution of Ingram's cultivar by the Morris Arboretum. There seems to be no valid reason to replace the original, well-established spelling, "incam," for the later variant "incamp." It is appropriate to recognize Collingwood Ingram as the author of this epithet, since he was the first to apply the name to this plant (Royal Horticultural Society, 1947a). It is questionable whether Ingram originally intended "Incam" as the epithet of a Latin binomial. In the first publications where it appeared (Royal Horticultural Society, 1947a: 374, 1947b: lvi), Ingram may have intended "Incam" merely as a shorthand notation of parentage, combining a syllable from each of the parent species. However, *P. incam* does not fit the definition of a hybrid formula as given in Article 23.6d and H.10.3 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006). Ingram (1970: 182, 193) casually referred to seedlings of *P. incisa* × *P. campanulata* as the Incam grex. In the six decades that have passed since *P. incam* was first published, *incam* has come into common use as the Latin epithet for the hybrid *P. incisa* × *P. campanulata*. Meyer et al. (1993) cited this taxon as *P.* ×*incam* Fletcher, attributing it to H. R. Fletcher, the author of the 1954 article presenting plants that received awards from the Royal Horticultural Society that year (Fletcher, 1954). However, Fletcher's publication lacked Latin descriptions, so that the hybrid name was not validated in this publication. Meyer et al. may have overlooked several earlier articles on *P. incisa* × *P. campanulata* hybrids (Ingram, 1942, 1948; Royal Horticultural Society, 1947a, b) and the first publication of *P. incam* (Royal Horticultural Society, 1947a).

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Alyssum misirdalianum (Brassicaceae), a New Species from Southern Turkey

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ABSTRACT. A new species, *Alyssum misirdalianum* Orcan & Binzet (Brassicaceae), is described from southern Anatolia, Turkey. The new species is restricted to southern Anatolia, in the southern part of Mersin Province. The morphological characters (oblanceolate leaves, obovate and glabrous petals, and ovate siliculae, 6–7 × 3–4.5 mm) support its placement in *Alyssum* L. sect. *Gamosepalum* (Haussknecht) Dudley, and the species appears to be most closely related to *A. corningii* Dudley.

Key words: *Alyssum*, Brassicaceae, IUCN Red List, Turkey.

The genus *Alyssum* L. (Brassicaceae) includes 89 species in the area covered by the *Flora of Turkey and the East Aegean Islands* (Dudley, 1965). Later studies have added new records (Dudley et al., 1997; Orcan, 1999; Orcan & Mısırdalı, 2000; Ünal & Behçet, 2003; Orcan & Binzet, 2006) and new species (Aytaç & Duman, 2000; Orcan, 2005) to this total. Including the new species described here, the total number of *Alyssum* species in Turkey is increased to 97.

In 2002, a new specimen of *Alyssum* was collected with fruit in the plateau of Fındıkpınarı (Mersin Province) in Turkey. After research of the literature (Dudley 1964a, b, 1965; Ball & Dudley, 1996) and comparison of the new material with *Alyssum* specimens deposited at ANK, GAZI, HUB, and the herbarium of Mersin University, we determined that the new specimens were different from all other Turkish specimens and should be described as a new species.

Alyssum misirdalianum Orcan & Binzet, sp. nov. TYPE: Turkey. Mersin Prov.: Fındıkpınarı, Deve Koyağı, 1800 m, stony slopes, 30 June 2002, *N. Orcan 500* (holotype, ANK; isotypes, GAZI, MO). Figure 1.

Haec species *Alysso corningii* Dudley affinis, sed ab eo caule 10–20 cm (non 7–12 cm) alto, foliis oblanceolatis (non lineari-lanceolatis), petalis obovatis glabris (non late spathulatis et sparse stellatis) atque fructibus ovatis 6–7 × 3–4.5 mm sparse stellatis (non orbiculari-ovatis 3.5–4 × 2.5–3.5 mm dense stellatis) differt.

Suffruticose, strongly branched perennial; stems erect, 10–20 cm; indumentum dimorphic with 6- to 10-rayed stellate hairs; lepidote hairs ca. 0.25 mm diam. Leaves 5–15 × 2–3 mm, oblanceolate, obtuse or slightly acute, with stellate and lepidote hairs, decreasing in size upward. Inflorescence congested, fruiting raceme elongated, 2–5 cm. Flowers with sepals 3–3.5 mm, ovate, apex acute, margins membranous, with a tuft of long, divergently rayed, stellate hairs at the apex, sepals deciduous in fruit; petals 4–5 mm, obovate, rotund or truncate, glabrous, constricted below the limbs, claws denticulate; filaments of long stamens 3–3.5 mm, with connate or free appendages, ca. 1.5–2 mm; filaments of short stamens 2–2.5 mm, with connate appendages up to 1.5 mm; styles 2–3 mm, with sparse stellate hairs in the lower half. Siliculae 6–7 × 3–4.5 mm, ovate, truncate-emarginate, with sparse stellate hairs ca. 0.25 mm diam.; seeds ca. 1.5 mm, ovoid, brownish green, narrowly winged.

Distribution and habitat. *Alyssum misirdalianum* inhabits stony slopes at an altitude of ca. 1800 m. It is endemic to Mersin Province, Turkey, where it is only known from the type locality.

IUCN Red List category. *Alyssum misirdalianum* is endemic to southern Anatolia, in the Mediterranean region. The specimens were collected in Mersin Province (C5), and the new species is known only from the type locality in an area of approximately 200 km^2. The population is not in good condition and therefore should be regarded as Endangered (EN) according to IUCN Red List criteria (IUCN, 2001).

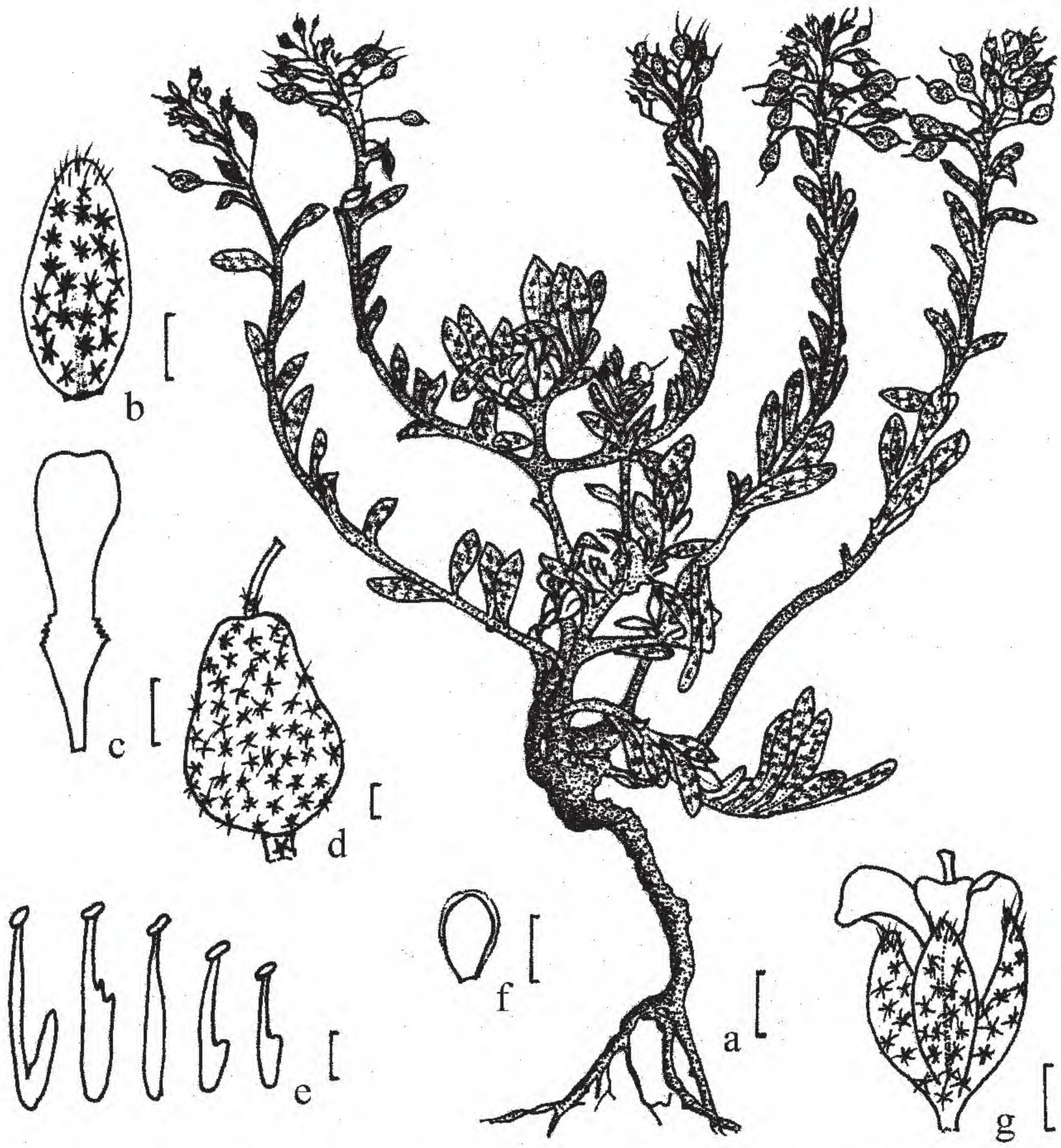

Figure 1. *Alyssum misirdalianum* Orcan & Binzet. —a. Habit. —b. Sepal. —c. Petal. —d. Fruit. —e. Stamens. —f. Seed. —g. Flower. Scale bars: a = 1 cm, b–g = 1 mm. Drawn from the holotype *N. Orcan 500* (ANK).

Phenology. The new species is known to flower in May and June and to fruit in June and July.

Etymology. It gives us great pleasure to name the new species after Hüseyin Mısırdalı, who was Nermin Orcan's supervisor during her Ph.D. study.

Discussion. Alyssum misirdalianum should be placed in section *Gamosepalum* (Haussknecht) Dudley because of its perennial habit, dimorphic sepals, and 2-ovulate locule. *Alyssum tetrastemon* Boissier, *A. thymops* (Huber-Morath & Reese) Dudley, *A. baumgartnerianum* Bornmüller, *A. corningii* Dudley, and *A. lycaonicum* (O. E. Schulz) Dudley, which are distributed in southern Turkey, also belong to section *Gamosepalum. Alyssum misirdalianum* is closely related to *A. corningii*, but can be distinguished by

Table 1. Morphological comparison of *Alyssum misirdalianum* with the related species *A. corningii* in Turkey.

	A. misirdalianum	*A. corningii*
Stem length (cm)	10–20	7–12
Leaf blade	5–15 × 2–3 mm, oblanceolate, obtuse or acute	6–10 × 0.5–2.5 mm, linear-lanceolate, acute
Sepals	ovate	ovate-lanceolate
Petals	obovate, rotund or truncate, glabrous	broadly spatulate, entire or subretuse, with sparse hairs on claws
Siliculae	6–7 × 3–4.5 mm, ovate, with sparse stellate hairs	3.5–4 × 2.5–3.5 mm, orbicular-ovate, with dense stellate hairs
General distribution	South Anatolia (C5)*	Central Anatolia (B4, B5, C4, C5)*

*Regional designations per *Flora of Turkey*.

its oblanceolate leaves (vs. linear-lanceolate), obovate, rotund or truncate, and glabrous petals (vs. broadly spatulate, entire or subretuse, with sparse hairs on claws), and ovate silicula, 6–7 × 3–4.5 mm (vs. orbicular-ovate, 3.5–4 × 2.5–3.5 mm) (Table 1).

The two species can be distinguished by the following key:

1a. Plants 10–20 cm; petals obovate, rotund or truncate, glabrous; silicula ovate, 6–7 × 3–4.5 mm . . . . . *A. misirdalianum*

1b. Plants 7–12 cm; petals broadly spatulate, entire or subretuse, with sparse hairs on claws; silicula orbicular-ovate, 3.5–4 × 2.5–3.5 mm . . . *A. corningii*

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Two New Species of *Stylogyne* (Myrsinaceae) from Brazil

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ABSTRACT. During routine identification of material of the genus *Stylogyne* A. DC. (Myrsinaceae), two new Brazilian species, *S. dusenii* Ricketson & Pipoly from the state of Paraná and *S. racemiflora* Ricketson & Pipoly from the state of Amazonas, are described and illustrated and their phylogenetic relationships are discussed.

RESUMEN. Durante el transcurso de identificar material herborizado perteniciente al género *Stylogyne* A. DC. (Myrsinaceae) se descubrió dos especies nuevas brasileñas del mismo, *S. dusenii* Ricketson & Pipoly proveniente del estado de Paraná y *S. racemiflora* Ricketson & Pipoly proveniente del estado de Amazonas. Se describan, se ilustran ambas especies y se discutan su parentezco.

Key words: Amazonas, Brazil, IUCN Red List, Myrsinaceae, Paraná, *Stylogyne*.

The Neotropical genus *Stylogyne* A. DC. (Myrsinaceae) comprises approximately 36 species, and numerous species remain undescribed owing to a lack of adequate material. Understanding the systematic biology of this genus has long been problematic because of its sexual lability. Androdioecious, bisexual, polygamo-dioecious, and dioecious species of *Stylogyne* have been documented (Pipoly, 1989, 1991, 1999; Ricketson & Pipoly, 1997, 2003; Pipoly & Ricketson, 1999, 2000), as well as the consequent morphological variation due to sexual expression. Within the family, *Stylogyne* has often been confused with *Geissanthus* Hooker f. and *Ardisia* Swartz.

During routine identification of Brazilian material of Myrsinaceae, two new species of *Stylogyne* were discovered and are described here.

1. **Stylogyne dusenii** Ricketson & Pipoly, sp. nov. TYPE: Brazil. Paraná: Volta Grande, 19 Nov. 1911 (fl.), *P. Dusén s.n.* (holotype, GH; isotype, S not seen). Figure 1.

Species haec inter congeneros flores 4-meros praebentes inflorescentiis expansis pinnatim bipinnatimve paniculatis et lamina folari secus margines crenata crenulatave singulariter distinguenda; quoad laminam secus margines crenatam vel crenulatam *Stylogynae warmingii* Mez arctissime affinis sed ab ea lamina foliari 8–12 × 3.4–4.9 (non 5.5–8.5 × 2.5–3.5) cm, inflorescentiis terminalibus (non lateralibus) pinnatim bipinnatimve paniculatis atque pedicellis 7–7.5 (non ad usque 3) mm longis praeclare distinguitur.

Shrub or small tree of unknown height; *branchlets* ca. 2 mm diam., terete, smooth, glabrous. *Leaves* alternate; *blades* membranous, elliptic, 8–12 × 3.4–4.9 cm, apically acute, acumen to 1 cm, basally cuneate, midrib channeled adaxially, prominently raised abaxially, secondary veins numerous, brochidodromous, inconspicuously raised adaxially and abaxially, smooth adaxially, inconspicuously punctate and punctate-lineate, glabrous, margins flat, crenate to crenulate; petioles marginate, 8–12 mm, slender, glabrous. *Bisexual inflorescence* terminal, a slender bipinnately compound, open pyramidal panicle, 2.8–3.2 × 6.7–7.4 cm, wider than long, usually shorter or as long as the leaves, branchlets and rachis glabrous, the fertile branches open, loosely congested into 7- to 11-flowered corymbs; peduncle terete, nearly obsolete to 1.3 mm, glabrous; inflorescence bracts absent; inflorescence branch bracts very early caducous, unknown; floral bracts membranous, lanceolate, 0.9–1.1 × 0.2–0.4 mm, apically acuminate, prominently punctate and punctate-lineate, glabrous, margins irregular, minutely erose, hyaline; pedicels slender, terete, 7–7.5 mm, inconspicuously punctate and punctate-lineate, glabrous. *Bisexual flowers* 4-merous; calyx lobes membranous to chartaceous, widely ovate to orbicular, 0.5–0.7 × 1.1–1.3 mm, apically acute to obtuse, prominently punctate to punctate-lineate, glabrous, margins irregular, minutely erose, hyaline; corolla white, membranous, 4.5–4.8 mm, tube 0.2–0.3 mm, lobes oblong, 4–4.3 × 2–2.3 mm, apically broadly acute to obtuse, prominently punctate and

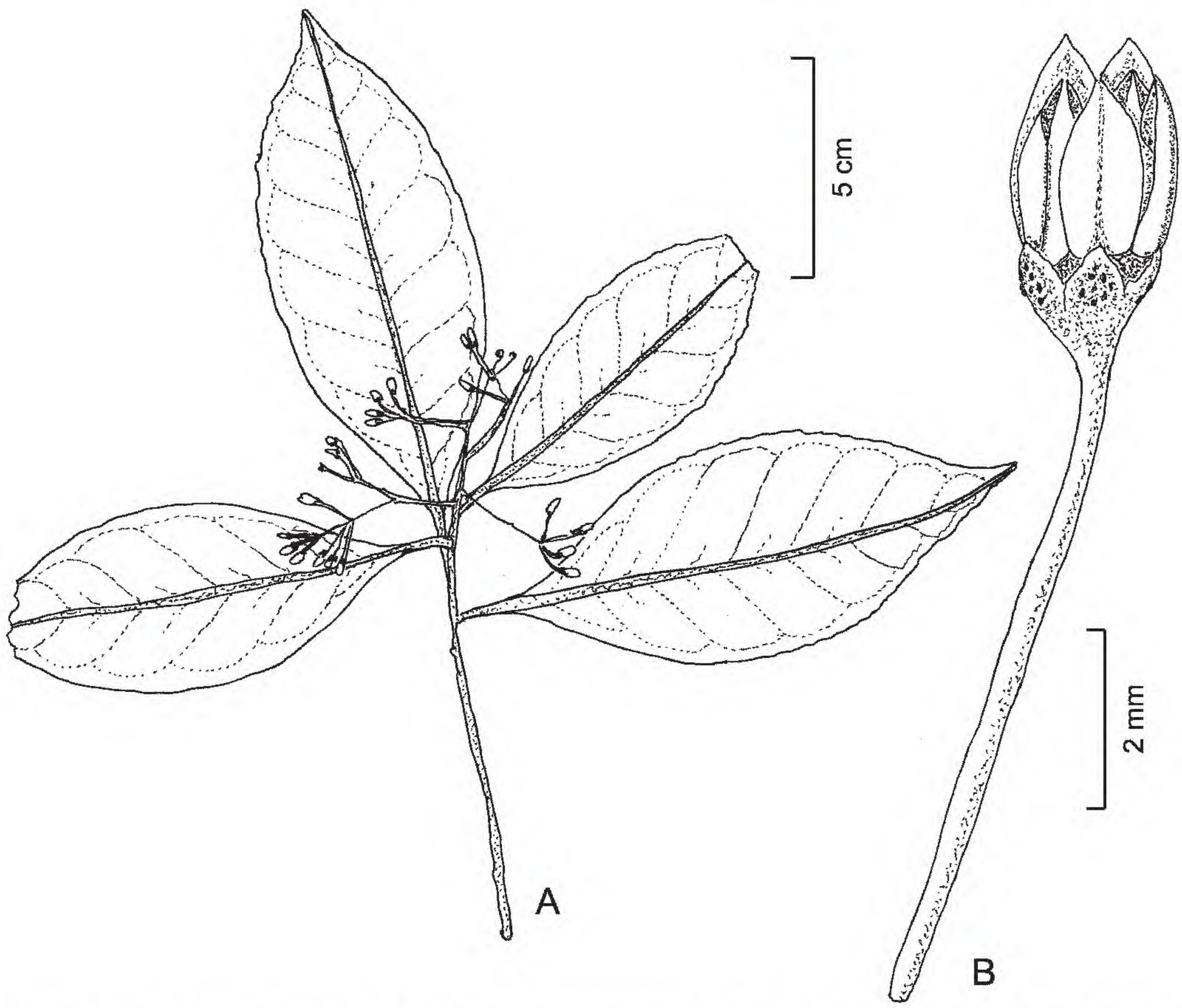

Figure 1. *Stylogyne dusenii* Ricketson & Pipoly. —A. Flowering branch. —B. Detail of bisexual flower, with two corolla lobes removed. Drawn from the holotype *P. Dusén s.n.* (GH).

punctate-lineate, glabrous, margins entire, hyaline; stamens 3–3.6 mm, filaments 1.3–1.8 mm, staminal tube 0.2–0.4 mm, the apically free portion 1.1–1.6 mm, anthers broadly ovoid to oblong, 2–2.2 × 0.7–1 mm, apically apiculate, basally cordate, connective conspicuously punctate; pistil 2.9–3.1 mm, prominently punctate, glabrous, ovary ovate, 1.1–1.3 mm, style 1.5–1.7 mm, prominently punctate and punctate-lineate, ovules 5 to 12. *Fruits* unknown.

Distribution. *Stylogyne dusenii* is known only from the type collection, from Paraná, Brazil, located between 800 and 900 m in elevation.

Ecology and IUCN Red List category. The new species was collected from primary dense forest and cerrado vegetation; this vegetation type experiences a dry season from April to August. Given that the Volta Grande Dam has created a significant reservoir and interrupted the Grande River, the protection the area affords does not outweigh the susceptibility of the ecosystem to fires and to further development, since the region is located between two large interstate highways, just northeast of Curitiba in Brazil. Therefore, given the precarious habitat, its proximity to major development, and the species being known only from one collection not seen for 97 years, the taxon should be considered Critically Endangered (CR B1a) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The new species is named for the collector, Per Karl Hjalmar Dusén (1855–1926).

Discussion. *Stylogyne dusenii* is unique among the 4-merous members of the genus, with its open, expanded, pinnate to bipinnate inflorescences and crenate to crenulate leaf blade margins. *Stylogyne dusenii* is most closely related to *S. warmingii* Mez, because of their shared crenate to crenulate leaf margins, but *S. dusenii* differs by its larger leaf blades (8–12 × 3.4–4.9 cm), its inflorescences terminal and pinnate to bipinnate, and its longer pedicels (7–7.5 mm long). *Stylogyne warmingii* has shorter leaf blades (5.5–8.5 × 2.5–3.5 cm), inflorescences that are laterally positioned and once pinnate, and shorter pedicels (to 3 mm long).

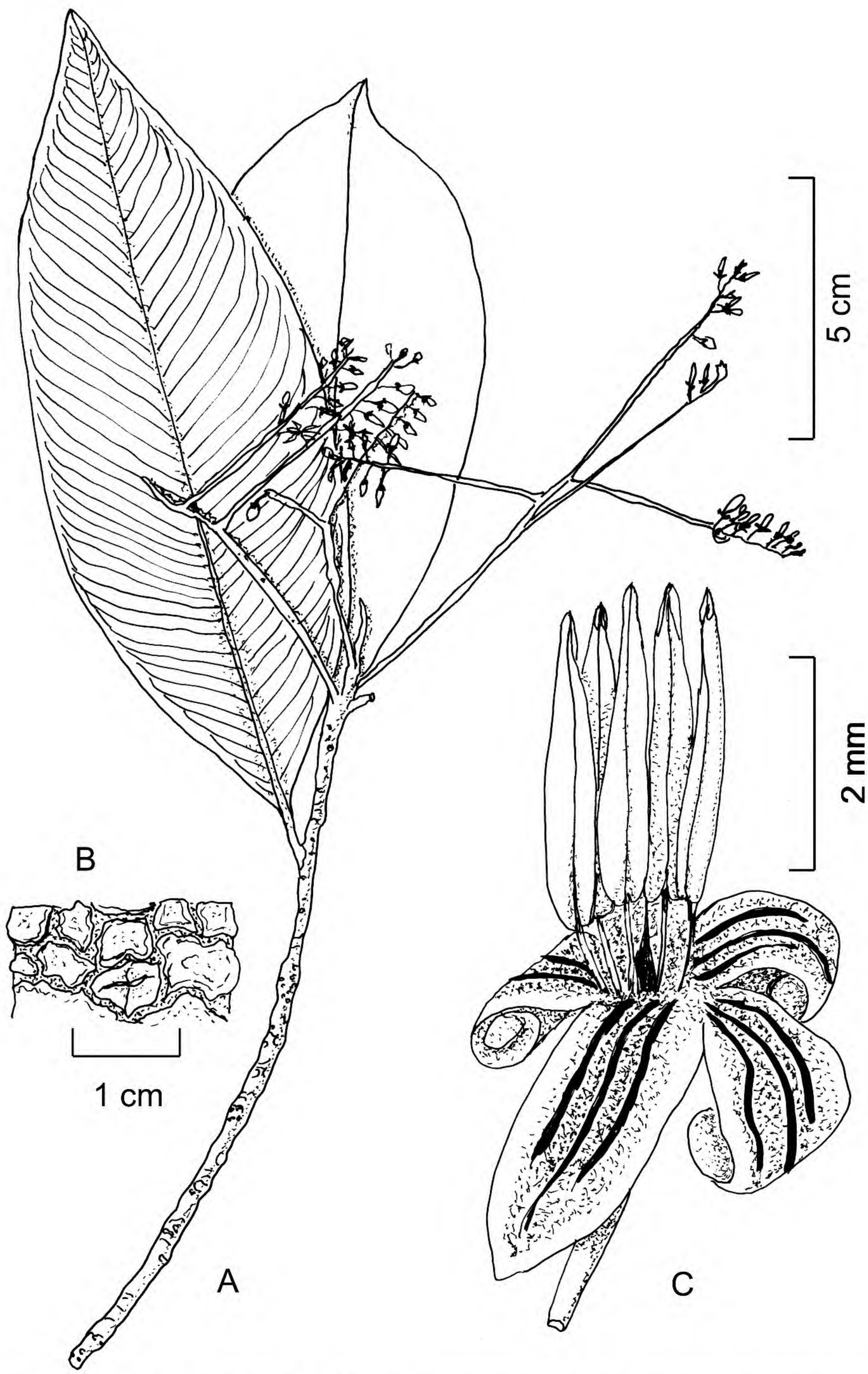

Figure 2. *Stylogyne racemiflora* Ricketson & Pipoly. —A. Flowering branch. —B. Detail of stem showing the scrolled, scaly bark. —C. Bisexual flower. A, C drawn from the holotype *C. Farney et al. 1705* (MO); B drawn from *B. Nelson 2603* (MO).

2. Stylogyne racemiflora Ricketson & Pipoly, sp. nov. TYPE: Brazil. Amazonas: Mpio. São Gabriel da Cachoeira, Morro dos Seis Lagos, Lago do Dragão, 400–450 m, 14–15 Oct. 1987 (fl.), *C. Farney, D. Daly, D. Stevenson, J. Oliveira & R. de Lima 1705* (holotype, MO; isotypes, INPA, MO). Figure 2.

Quoad flores 5-meros inflorescentias laterales necnon laminas foliares chartaceas usque coriaceas species haec cum *Stylogyne rodriguesiana* Pipoly primo intuitu confusa est, sed ab ea ramulis paniculae racemosis (non corymbosis), lobis calycinis deltatis (non anguste ovatis) 1.5–1.6 × 1.5–1.6 (nec 1.8–2.2 × 1–1.3) mm, lobis corallinis 3.5–3.7 × 1.2–1.4 (non 3.9–4.5 × 1.5–1.6) mm, denique antheris 3.1–3.2 (non 2.5–3.1) mm longis perfacile recognoscitur.

Shrub or small tree 2–6 m, trunk 2.7–3 cm diam., the bark "scrolled scaly" (Junikka, 1994: 20); *branchlets* 3–5 mm diam., terete, smooth, glabrous. *Leaves* alternate; *blades* chartaceous to coriaceous, oblong to elliptic, 7.2–20.3 × 3.4–6.4 cm, apically acute to acuminate, acumen 1–1.5 mm, basally acute, midrib channeled adaxially, prominently raised abaxially, secondary veins numerous, brochidodromous, inconspicuously raised adaxially and abaxially, smooth and waxy adaxially, inconspicuously punctate and punctate-lineate, glabrous, margins flat, entire; petioles canaliculate, 8–14 mm, stout, glabrous. *Bisexual inflorescences* lateral, appearing pseudoterminal, as an open pinnate panicle of racemes, 5.5–12 × 3–11 cm, usually shorter than the leaves, branchlets and rachis glabrous, the few branches open, 10- to 24-flowered racemes; peduncles terete, slender, 2.3–3.5 cm, glabrous; bracts and inflorescence branch bracts unknown; floral bracts membranous, ovate to rounded, 0.7–0.9 × 0.7–0.9 mm, apically obtuse to broadly acute, inconspicuously punctate and punctate-lineate, glabrous, margins irregular, minutely erose, hyaline; mature pedicels slender, terete, 3.2–4 mm, inconspicuously punctate to punctate-lineate, glabrous. *Bisexual flowers* 5-merous; calyx lobes chartaceous to slightly coriaceous, deltate, 1.5–1.6 × 1.5–1.6 mm, apically acute, prominently punctate to punctate-lineate, glabrous, margins undulate, hyaline, slightly erose; corolla greenish white, thickly membranous to chartaceous, 4.8–5 mm, tube 1.3–1.5 mm, lobes oblong, 3.5–3.7 × 1.2–1.4 mm, apically broadly acute to obtuse, prominently punctate and punctate-lineate, glabrous, margins entire, hyaline; stamens 4.8–5 mm, filaments 1.8–2 mm, staminal tube 0.2–0.3 mm, the apically free portion 1.6–1.8 mm, anthers narrowly linear to narrowly lanceolate, 3.1–3.2 × 0.4–0.5 mm, apically apiculate, basally narrowly cordate, connective inconspicuously punctate; pistil 4.8–5 mm, prominently punctate, glabrous, ovary ovate, 2–2.2 mm, style 2.8–3 mm, prominently punctate and punctate-lineate, ovules 3 to 7. *Fruits* unknown.

Distribution. *Stylogyne racemiflora* is restricted to the Morro dos Seis Lagos area, within the binational Parque Nacional Pico da Neblina, with the type locality noted around 400 m in elevation.

Ecology and IUCN Red List category. The area is characterized by Cretaceous igneous rocks notable for their commercially valuable niobium-containing minerals that occur as intrusions into the pre-Cambrian sandstone of the Guayana Highland. Given the park's boundary position and the commercial and global strategic value of the naturally scarce niobium, the location is considered one of the best guarded along the Brazil–Venezuela border. As such, the species should be considered of Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The specific epithet is in reference to the unique racemose branches of the inflorescence.

Discussion. *Stylogyne racemiflora* is endemic to the Morro dos Seis Lagos area from numerous collections. It was originally confused with and is most closely related to *S. rodriguesiana* Pipoly. Both species have 5-merous flowers, glabrous, expanded lateral inflorescences, and chartaceous to coriaceous leaf blades. However, *S. racemiflora* differs in having an inflorescence of an open pinnate panicle of racemes, broadly ovate calyx lobes (1.5–1.6 × 1.5–1.6 mm), smaller corolla lobes (3.5–3.7 × 1.2–1.4 mm), and longer anthers (3.1–3.2 mm long). *Stylogyne rodriguesiana* has an inflorescence of an open bi- or tripinnate panicle of corymbs, narrowly ovate calyx (1.8–2.2 × 1–1.3 mm), larger corolla lobes (3.9–4.5 × 1.5–1.6 mm), and shorter anthers (2.5–3.1 mm).

Much of the material of *Stylogyne racemiflora* was previously regarded as paratypes of *S. rodriguesiana* (Pipoly, 1991). The original description of *S. rodriguesiana* is based on the type material *W. Rodrigues & Chagas 3092* (INPA, NY). The only portion of the *S. rodriguesiana* description that needs to be altered is a portion of the discussion that references "racemose branchlets of the panicles" (Pipoly, 1991: 202). However, *S. rodriguesiana* is clearly characterized by an open bi- or tripinnate panicle of corymbs.

Paratypes. BRAZIL. **Amazonas:** Mpio. São Gabriel da Cachoeira, Morro dos Seis Lagos, 00°20′N, 066°45′W, 400 m, 30 Sep. 1990 (st.), *B. Nelson 2077* (INPA, MO), (fl.), *B. Nelson 2142* (INPA, MO), (st.), *B. Nelson 2150* (INPA, MO), (fl.), *B. Nelson 2354* (INPA, MO), *2603* (INPA, MO).

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New Species of *Lachemilla* (Rosaceae) from South America

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Abstract. Two new species of *Lachemilla* (Focke) Rydberg (Rosaceae) from the Andes of Ecuador and Colombia are described and illustrated. *Lachemilla llanganatensis* Romoleroux, from Ecuador, is characterized by its loosely ascending habit, sparsely short-hispid indumentum, presence of entire basal leaves, and ascending to spreading, verticillate stem leaves. The flowers are grouped in cymes of three to six flowers, with spreading sepals and episepals, and the hypanthia are often sparsely hirsute. *Lachemilla kieftiana* Romoleroux, from Colombia, is distinguished by its stoloniferous habit and basal leaves in rosettes with subreniform to 3-lobed, sericeous blades. The flowers are grouped in cymes of three to 10 flowers, subsessile, floral bracts free, with ascending sepals and episepals, and the hypanthia are mostly sericeous.

Resumen. Se describen e ilustran dos nuevas especies de *Lachemilla* (Focke) Rydberg (Rosaceae) de los Andes de Ecuador y Colombia. *Lachemilla llanganatensis* Romoleroux, del Ecuador, se caracteriza por su hábito ascendente, pubescencia esparcidamente hispidula, presencia de hojas basales enteras, y hojas distales verticiladas con lóbulos foliares acendentes a horizontales. Flores agrupadas en cimas de tres a seis flores, con sépalos y episépalos horizontales e hipantio esparcidamente hirsuto. *Lachemilla kieftiana* Romoleroux, de Colombia, se distingue por el hábito estolonífero y hojas basales en roseta, láminas subreniformes, sericeas. Flores agrupadas en cimas de tres a 10 flores, sésiles o subsésiles, brácteas florales libres, y sépalos y episépalos ascendentes e hipantio sericeo.

Key words: Andes, Colombia, Ecuador, IUCN Red List, *Lachemilla*, Rosaceae.

Lachemilla (Focke) Rydberg is a Neotropical genus of perennial herbs and shrubs with approximately 75 species, occurring from the southern high mountains of Mexico to northern Chile and Argentina. Species diversity is highest in the region from Venezuela to Ecuador (Romoleroux, 2004). *Lachemilla* is recorded as an important and species-rich genus in páramos, where it can form dense stands, and together with other páramo plants serves as source of water. *Lachemilla* was initially described as a section of *Alchemilla* L., a genus distributed in Europe, Asia, and northern Africa (Focke, 1888; Perry, 1929). Rydberg (1908) and Rothmaler (1937), however, treated *Lachemilla* as a genus distinct from *Alchemilla* on the basis of floral differences and geographic distribution. A complete monograph of *Lachemilla* is currently being prepared by the author, since the last published revision was that of Perry (1929). Preliminary molecular studies on *Lachemilla* have shown that *Lachemilla* is monophyletic and that it is closely related to *Alchemilla* and *Aphanes* L. (Gehrke et al., 2008).

The purpose of this paper is to describe two new species of *Lachemilla* from the Andes of Ecuador and Colombia. The following new species were discovered during comprehensive study of the genus.

1. **Lachemilla llanganatensis** Romoleroux, sp. nov. TYPE: Ecuador. Tungurahua: Cordillera de Llanganates, Páramo de Jaramillo, 78°22′W, 1°10′S, 4000–4250 m, 2 Nov. 1984, *S. Laegaard 53287* (holotype, AAU; isotype, QCA). Figure 1.

Haec species quoad indumentum hispidum etiam folia caulina reducta vaginas lobatas verticillatas formantia *Lachemillae hispidulae* (L. M. Perry) Rothmaler similis, sed ab ea habitu laxe ascendenti, pubescentia sparsim breviterque hispida, praesentia foliorum basalium, lobis distalibus foliorum caulinorum ascendentibus vel patentibus, sepalis et episepalis patentibus atque hypanthio interne et acheniis basaliter plerumque sparsim hirsutis distinguitur.

Subshrubs; stems loosely ascending, slightly branched at apex, sparsely short-hispid. Basal leaves usually present, blades obovate in outline, 3- to 5-lobed at apex, 4–6.5 × 2.8–4 mm, coriaceous, margins serrate, sparsely villous mostly on the veins; petioles 1–3 mm; stipules usually present, 4–8 mm, basally adnate to petioles, free at the apex, membranous, brown. Stem leaves reduced, adnate with stem stipules to form verticillate, lobed sheaths, sheath lobes 6 to 9, spreading at maturity, deltate-lanceolate, 3–5 × 1–2 mm (3/4 to 2/5 of the entire sheath length),

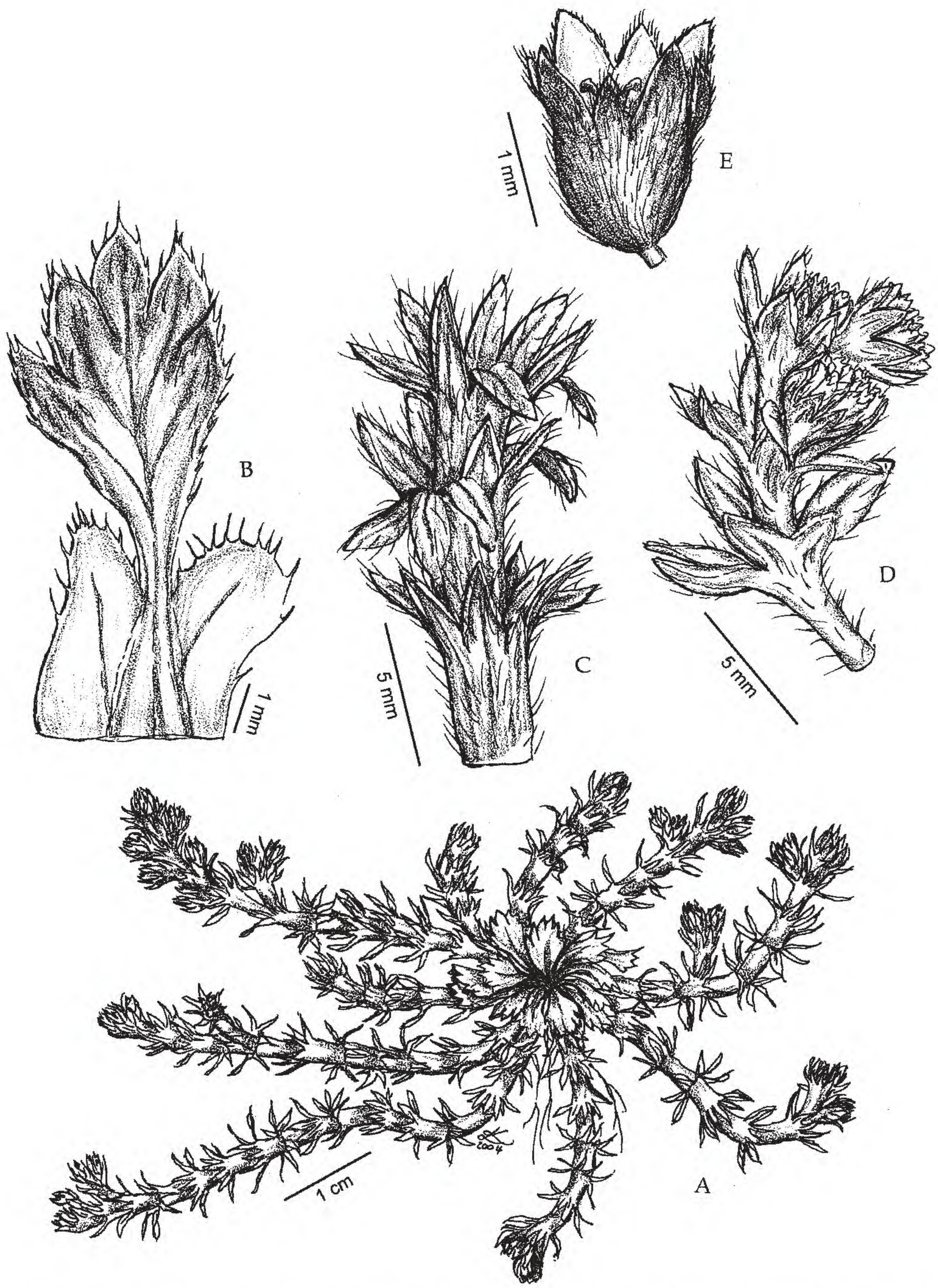

Figure 1. *Lachemilla llanganatensis* Romoleroux. —A. Habit. —B. Basal leaves with stipules. —C. Branch with lobed sheaths formed by stipules and reduced leaves. —D. Flowering branch. —E. Flower. Drawn from the holotype *S. Laegaard 53287* (AAU).

coriaceous, margins strongly revolute. Inflorescences of terminal and axillary glomerulate 3- to 6-flowered cymes; floral bracts lobed, ascending; pedicels 0.1–0.4 mm, hirsute, or absent. Flowers 1.7–2.3 mm; hypanthium turbinate to globose at maturity, 1–1.5 × 0.8–1.2 mm, appressed-villous outside, glabrous or sparsely hirsute within, with reddish glands at base of hairs; episepals and sepals spreading to curved or

slightly connivent at maturity, green, abaxially pilose to hirsute, adaxially glabrous; episepals 4, deltate, 0.3–0.55 × 0.2–0.4 mm; sepals 4, ovate-deltate, 0.7–0.8 × 0.4–0.6 mm; stigmas subclavate. Achenes 2, ovoid-globose, 0.9–1.2 × 0.7–0.8 mm, surface slightly reticulate, usually sparsely hirsute at base.

Distribution, habitat, and phenology. *Lachemilla llanganatensis* is known from the Cordillera de los Llanganates, in the east-central Ecuadorian Andean region, from 3950–4350 m. It has been found growing in windswept open rocky areas and in bunchgrass páramo with *Swallenochloa* McClure spp. and other *Lachemilla* spp. The species was collected in flower in November.

IUCN Red List category. *Lachemilla llanganatensis* should be classified as DD (Data Deficient) according to IUCN Red List criteria (IUCN, 2001). The species has been found in a limited area of distribution, which suggests that it is a rare taxon. It is possible, however, that the species still persists in nearby areas with similar habitats.

Etymology. The specific epithet of *Lachemilla llanganatensis* is derived from the Cordillera de los Llanganates, where the type was collected. The Cordillera de los Llanganates is known for being difficult to access and is the subject of Incan legends.

Relationships. *Lachemilla llanganatensis* resembles *L. hispidula* (L. M. Perry) Rothmaler in its hispid indumentum and reduced stem leaves that form verticillate lobed sheaths. However, *L. llanganatensis* differs in its loosely ascending habit, short-hispid indumentum, the presence of basal leaves, the spreading to curved stem leaf lobes, the spreading sepals and episepals, and the sparsely hirsute internal basal part of the hypanthia and achenes.

Paratypes. ECUADOR. **Tungurahua:** Cordillera de los Llanganates, upper steep rocky part of Cerro Hermoso, 1°9′S, 78°21′W, 4100 m, 11 Nov. 1980, *L. Holm-Nielsen & J. Jaramillo 28449* (AAU); Páramo de Jaramillo, 12 km NW of Cerro Hermoso, 1°13′S, 78°17′W, 4350 m, 13 Nov. 1980, *L. Holm-Nielsen & J. Jaramillo 28817* (AAU). **Tungurahua-Napo:** shoulder of Cerro Hermoso, 1.5 km W of the summit, 1°13′S, 78°18′W, 3950 m, 12 Nov. 1980, *L. Holm-Nielsen & J. Jaramillo 28739* (AAU).

2. Lachemilla kieftiana Romoleroux, sp. nov. TYPE: Colombia. Magdalena: Sierra Nevada de Santa Marta, SE slopes, Hoya del Rio Donachuí, Laguna de Calocribe (E of Meollaca), páramo 3600–3700 m, 30 Sep. 1959, *J. Cuatrecasas & R. Romero-Castañeda 24554* (holotype, U; isotype, NY). Figure 2.

Haec species quoad habitum, indumentum etiam foliorum formam *Lachemillae uniflorae* Maguire similis, sed ab ea foliis majoribus, hypanthio extus pro parte maxima sericeo atque episepalis brevioribus distinguitur.

Herbs stoloniferous; branches decumbent, ± sericeous-villous. Basal leaves in rosettes, blades subreniform in outline, slightly 3-lobed, 8–12 × 15–21 mm, chartaceous, lateral lobes occasionally bilobed, margins crenulate-serrate, abaxially sericeous mostly on the veins, adaxially sericeous-villous to sparsely villous; petioles 8–20 mm; stipules 4–7 mm, basally adnate to petiole, free and acute at the apex, membranous, entire, brown. Stem leaves absent or reduced, 3-parted, 5–6.5 × 1.5–3 mm, adnate to the stipular lobes at base; stipular lobes 3–5 × 1.2–2 mm, deltate, spreading to curved. Inflorescence of axillary and terminal, glomerulate, 3- to 10-flowered cymes; floral bracts lobed, ascending or spreading; pedicels to 0.5 mm, or absent. Flowers 1.5–2.3 mm; hypanthium elongate to urceolate at maturity, 0.7–1.3 × 0.5–0.8 mm, glabrescent at base to sericeous at apex outside, glabrous within, reddish brown; episepals and sepals ascending, brownish red, abaxially sparsely sericeous, adaxially glabrous; episepals 4, deltate, 0.6–0.7 × 0.25–0.35 mm; sepals 4, deltate-ovate, 0.75–1 × 0.5–0.6 mm; stigmas clavate. Achenes 3 to 5, globose-ovoid, 0.8–1 × 0.6–0.8 mm, surface slightly reticulate-bullate, glabrous.

Distribution, habitat, and phenology. *Lachemilla kieftiana* is only known from the Sierra Nevada de Santa Marta in Colombia, between 3350 and 3700 m, where it grows in open páramo and scrub vegetation. The species has been collected in flower in September.

IUCN Red List category. *Lachemilla kieftiana* should be classified as DD (Data Deficient) according to IUCN Red List criteria (IUCN, 2001). The species has been found in a limited area of distribution, which suggests that it is a rare taxon. It is possible, however, that the species persists in nearby areas with similar habitats.

Etymology. The name of the species honors Bert Kieft, a former Ph.D. student at Utrecht University, who collected, studied, and identified many specimens of Andean *Lachemilla*.

Relationships. This new species is similar to *Lachemilla uniflora* Maguire in habit, indumentum, and form of the leaves. However, *L. kieftiana* differs by having larger leaves and cymes of three to 10 flowers. In *L. uniflora*, flowers are solitary or occasionally in few-flowered cymes of three to 10 flowers, the hypanthia mostly glabrous, and the episepals shorter than those of *L. kieftiana*.

Figure 2. *Lachemilla kieftiana* Romoleroux. —A. Habit. —B. Basal leaves with stipules. —C. Flowering branch. —D. Flower. Drawn from the holotype *J. Cuatrecasas & R. Romero-Castañeda 24554* (U).

Paratypes. COLOMBIA. **Magdalena:** Sierra Nevada de Santa Marta, "Vallecito de la Laguna Pérdida, entre la fila la Cumbre y la Cuchilla la Cimarrona," 3350 m, *O. Rangel 1385* (U); Caserío de San Sebastián, Bellavista, 3500 m, *O. Rangel 1985* (NY).

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A New Species of *Catolesia* (Asteraceae, Eupatorieae) from Bahia, Brazil

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Abstract. *Catolesia* D. J. N. Hind is an endemic, previously monotypic genus (Asteraceae, Eupatorieae) from the campos rupestres of Bahia, Brazil. A second species for the genus, *C. huperzioides* Roque, H. Robinson & A. A. Conceição, is recognized and described here. It is distinguished from *C. mentiens* D. J. N. Hind principally by the well-organized terminal synflorescence composed of (7)8 to 12 capitula, of which one is central and larger, its shorter leaves (4–5 mm vs. 7–19 mm in *C. mentiens*), its white corolla (vs. pink), and the pappus (a brief crown to 0.1 mm vs. mostly absent). *Catolesia huperzioides* is known only from the municipality of Mucugê and is probably endemic to the Chapada Diamantina Region of Bahia, Brazil.

Key words: Brazil, *Catolesia*, Compositae, Gyptidinae, IUCN Red List.

Catolesia D. J. N. Hind was recently described (Hind, 2000b) as a monotypic genus for the tribe Eupatorieae (Asteraceae) based on the taxon *C. mentiens* D. J. N. Hind. The genus exhibited obvious affinities with the subtribe Gyptidinae, especially in its spirally inserted leaves, the biseriate and not imbricate involucre, the paleaceous receptacle, the narrowly funnelform corolla tubes, and the eppapose cypsela with more or less procurrent upper margins to the carpopodium (Hind, 2000b).

The subtribe Gyptidinae of the tribe Eupatorieae is distributed mostly in eastern South America, with its greatest taxonomic diversity in the campos rupestres of Brazil. Of the 29 genera and ca. 135 species in the subtribe, 13 genera are exclusively Brazilian and nine are restricted to the state of Bahia (Hind & Robinson, 2007).

The taxonomy of the Gyptidinae has recently been discussed by Hind (1999, 2000a, b; Hind & Robinson, 2007), and three informal groups were recognized within the subtribe. *Catolesia* falls clearly into Hind's second group with "many-flowered capitula, densely spirally inserted leaves and many with variously defective pappus setae" (2000b: 944). According to Hind, *Catolesia* and *Agrianthus* Martius ex DC. are the only genera in the subtribe that possess paleaceous receptacles. However, *Agrianthus* differs by its pubescent stems, scale-like leaves that are densely prominently veined and without any hint of succulence, (2)3- to 5-seriate phyllaries, clavate style branches, and setiform pappus.

The new taxon is described and illustrated and ecological information is provided. The data presented here are based on literature revisions and an analysis of *Catolesia* collections and types available at ALCB, HUEFS, and US. Morphological studies using an Olympus SZH10 stereomicroscope (Olympus, Tokyo, Japan) were carried out on dried material.

Catolesia huperzioides Roque, H. Robinson & A. A. Conceição, sp. nov. TYPE: Brazil. Bahia: Mpio. Mucugê, Chapada Diamantina, Serra do Esbarrancado, 12°43′S, 41°30′W, 5 Sep. 2006, *A. A. Conceição & P. D. Carvalho 1804* (holotype, HUEFS). Figures 1, 2.

Haec species a *Catolesia mentiente* D. J. N. Hind synflorescentia terminali ex capitulis aggregatis sessililibus biformibus constante, foliis brevioribus (4–5 mm longis), corollis albis et pappo breviter coroniformi ca. 0.1 mm longo semper praesente distincta.

Candelabriform shrub 0.6–0.9 m; stems 0.4–1 cm diam., glabrous, branched from base, 6 to 8 branches pseudowhorled beneath old synflorescences, densely leafy in upper half, leaf blades lost on older stem but sheaths persistent. Leaves densely spiraled, imbri-

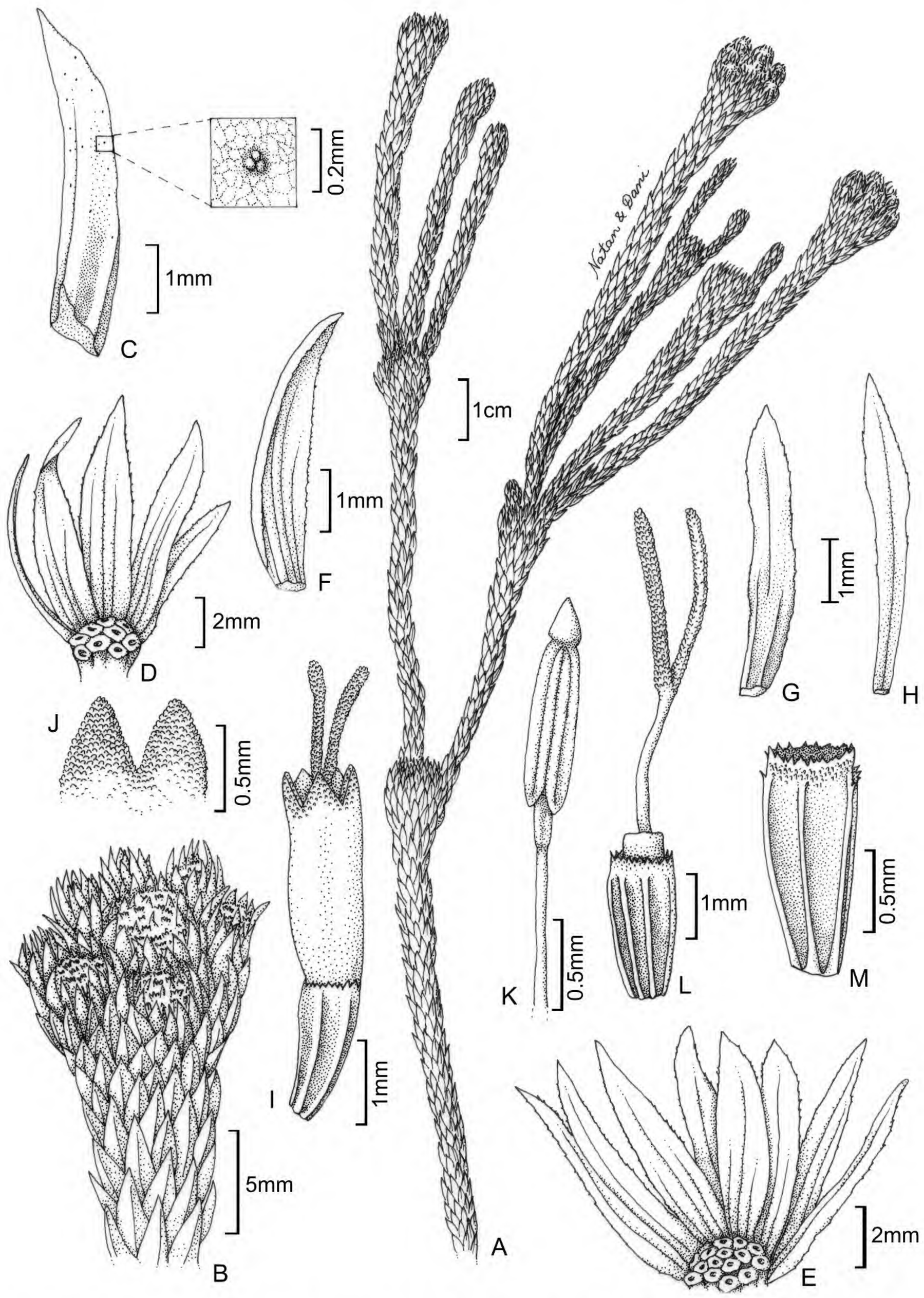

Figure 1. *Catolesia huperzioides* Roque, H. Robinson & A. A. Conceição. —A. Fertile habit. —B. Synflorescence on the apex of the branch showing eight capitula, with the central one significantly larger. —C. Detail for the lanceolate, somewhat succulent leaf with a cluster of three glandular dots shown at right. —D. Receptacle and involucre of a peripheral capitulum. —E. Receptacle and involucre of the central capitulum. —F. Outer phyllary. —G. Inner phyllary. —H. Palea. —I. Floret. —J. Papillose apices of two corolla lobes. —K. Stamen, showing appendage and collar. —L. Floret dissected to show the nectary surrounding the stylar base. —M. Cypsela with a short dentate to laciniate coroniform pappus. Drawn from the holotype *A. A. Conceição & P. D. Carvalho 1804* (HUEFS).

cate, sessile, simple, concolorous, lanceolate, slightly succulent in appearance, blades 4–5 × 0.7–0.9 mm, adaxially glabrous and pitted with 1 or an assemblage of glandular dots, abaxially glabrous, midrib carinate in both sides, blade margins in distal half undulate, apices acute, pungent and incurved. Synflorescences terminal, corymbose, more than 200 in a single plant, each 0.5–1 cm, 1–1.5 cm diam., hemispheric, sur-

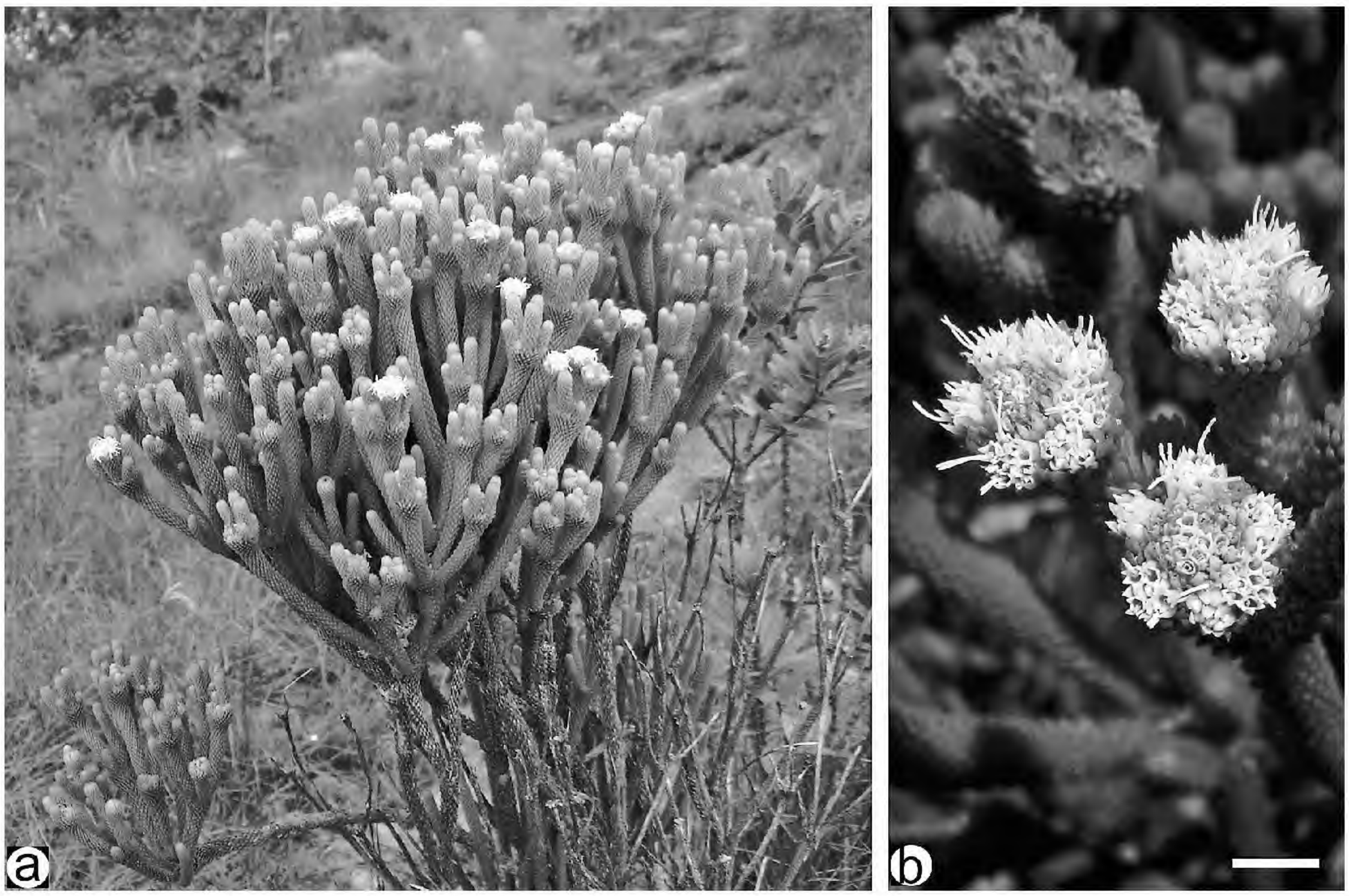

Figure 2. *Catolesia huperzioides* Roque, H. Robinson & A. A. Conceição. —A. Photo showing candelabriform habit and the strongly imbricate leaves. —B. Detail for three anthesal synflorescences revealing one larger central capitulum surrounded by ca. seven peripheral capitula. Photos by Abel A. Conceição taken at Mucugê, Bahia. Scale bar = 0.5 cm.

rounded by leaves subequal to the capitula; each synflorescence with (7)8 to 12 capitula, with 1 capitulum central and larger by its width and additional florets. Capitula homogamous, discoid, cylindric, sessile, the peripheral capitula 6–7 mm, 2–3 mm diam., the central capitulum 6–7 mm, ca. 5 mm diam.; bracteoles 3 to 5 per capitulum, leaflike, thick, linear, 4–5 × ca. 0.5 mm, outer surface and margins glandular-punctate in the epidermal pits, margins entire, ciliate, apices acute, mucronate. Involucre campanulate, phyllaries biseriate, cream, 17 to 20, distant, subequal, outer phyllaries 8 to 10, persistent, slightly keeled, with base inflated, lanceolate, 4–4.5 × ca. 0.5 mm, glabrous, margins slightly sinuate with stipitate-glandular cilia, apices acute, inner phyllaries 9 to 10, easily falling, slightly keeled, with base inflated, lanceolate, ca. 5 × 0.8–1.2 mm, margins with stipitate-glandular cilia, apices acute; receptacle convex, alveolate, glabrous, paleaceous, paleae 4 to 6, scattered among flowers, deciduous, slightly keeled, with base inflated, linear to spatulate, 4–5 × 0.5–0.7 mm, glabrous, margins with stipitate-glandular cilia, apices acute. Flowers bisexual, ca. 10 in peripheral capitula and 26 to 30 in central capitulum, 4.5–5.5 mm, corolla white, actinomorphic, 2.5–3 × ca. 1 mm, glabrous, corolla lobes 5, narrowly triangular, ca. 0.5 mm, papillose outside, margins involute; anther cylinder included within corolla

Table 1. Morphological differences between *Catolesia huperzioides* Roque, H. Robinson & A. A. Conceição and *C. mentiens*.

Characters	*C. mentiens*	*C. huperzioides*
Leaf shape	narrowly oblanceolate	lanceolate
Leaf size (mm)	7–19 × 1.1–2.1	4–5 × 0.7–0.9
Capitula	in loose groups at branch apices, capitula similarly sized, pedunculate	a synflorescence with (7)8 to 12 congested at branch apices, the central capitulum notably larger, all capitula sessile
Florets	ca. 20, corolla pink	ca. 10 in peripheral capitula and 26 to 30 in central capitulum, corolla white
Pappus	absent or very rarely with minute abortive setae on apical callus	short dentate to laciniate crown ca. 0.1 mm long

throat, oblong, ca. 1 mm, apical anther appendages triangular, ca. 0.2 mm, as long as wide, apices rounded, anther collar prominent and distinctly wider than filament; style ca. 3 mm, style branches linear to filiform, ca. 1.5 mm, papillose, nectary present. Cypsela 1.5–2 mm, 5-ribbed, glabrous; carpopodium inconspicuous; pappus a short dentate to laciniate crown ca. 0.1 mm.

Habitat and distribution. *Catolesia huperzioides* was collected from campos rupestres, at the summit and slopes of the Serra do Esbarrancado from 1450–1700 m, where there is frequent mist in the morning. The plants are found growing in sandy soil between rocks among herbs and shrubs. The new species is known only from the municipality of Mucugê and is probably endemic to the Chapada Diamantina Region of Bahia, Brazil.

IUCN Red List category. According to the available information about this species, it can be considered Critically Endangered (CR B1ab; B2ab) according to IUCN Red List criteria (IUCN, 2001) because of its restricted distribution (only one locality).

Etymology. The specific epithet alludes to the vegetative similarity of the new species to *Huperzia mooreana* (Baker) Holub (Lycophyta, Lycopodiaceae), a very common species in the Serra do Sincorá that is also found in the Chapada Diamantina Region.

Discussion. *Catolesia huperzioides* has all of the characteristics that distinguish the genus. The plant is a candelabriform shrub, poorly branched at the base, moderately branched in the upper half, and pseudo-whorled beneath old inflorescences; the leaves are slightly succulent and lack any nonglandular trichomes; the inflorescences are terminal and corymbose; and the receptacle is paleaceous. However, *C. huperzioides* has several interesting characters that distinguish the species. The principal differences include the leaves that are lanceolate with pungent and incurved tips (vs. narrowly oblanceolate, rather blunt, and not incurved at all in *C. mentiens*); smaller leaf blades (4–5 mm vs. 7–19 mm in *C. mentiens*); the capitula that form a highly congested terminal synflorescence composed of (7)8 to 12 capitula, sessile, congested, with the central capitulum markedly larger with twice as many florets (vs. the synflorescence in *C. mentiens* that is also composed of several capitula [10(to 12), rarely few (4)] but these more diffuse, similarly sized, and conspicuously pedunculate); and the cypsela with a short, coroniform pappus (vs. seta absent or abortive) (Table 1).

Catolesia huperzioides was collected in the same type of habitat as *C. mentiens*, in the campos rupestres of the Chapada Diamantina Region. Given the taxonomic diversity of the Gyptidinae in the campos rupestres, the discovery of the new species further supports the habitat as a major center of diversity for the subtribe within the state.

Paratypes. Brazil. **Bahia:** Mucugê, Chapada Diamantina, Serra do Esbarrancado, 12°44′S, 41°30′W, 24 Feb. 2005, *A. A. Conceição 1179* (HUEFS); Mucugê, Parque Nac. Chapada Diamantina, 12°42′S, 41°31′W, 4 Mar. 2006, *A. A. Conceição 1741* (HUEFS).

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Eleocharis gonzaleziae (Cyperaceae), a New Species from Northern Mexico

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ABSTRACT. *Eleocharis gonzaleziae* D. J. Rosen, a new species from the high plateau of northern Mexico, is described from the state of Durango and illustrated. Taxonomic notes on the new species are provided, including a comparison to a morphologically similar species, *E. bolanderi* A. Gray.

RESUMEN. *Eleocharis gonzaleziae* D. J. Rosen, una nueva especie del Altiplano del México norteño, se describe del estado de Durango y se ilustra. Las notas taxonómicas sobre la nueva especie se proporcionan, incluyendo una comparación a una especie morfológicamente parecida, *E. bolanderi* A. Gray.

Key words: Cyperaceae, *Eleocharis*, IUCN Red List, Mexico, subseries *Truncatae*.

Eleocharis R. Brown is a worldwide genus of about 200 species and about 600 published names and with a concentration of taxa in tropical America (González-Elizando & Tena-Flores, 2000). *Eleocharis* is characterized by bladeless leaf sheaths, its inflorescence comprising a single spikelet at the summit of the culm, bisexual flowers, and a fruit (achene) bearing a persistent style base or tubercle. The structural simplicity of *Eleocharis* morphology and lack of phylogenetically informative characters make it one of the most taxonomically difficult genera in Cyperaceae (González-Elizando & Tena-Flores, 2000). *Eleocharis* includes many difficult species complexes in need of taxonomic revision involving species that have never been clearly defined (Smith, 2001).

Eleocharis was first treated comprehensively by Svenson (1929, 1932, 1934, 1937, 1939), representing the first attempt to critically compare Old World and New World species. Svenson's (1929) worldwide monograph included a conservative infrageneric classification of 11 series and six subseries. A more recently proposed infrageneric classification (González-Elizondo & Peterson, 1997) comprises four subgenera, seven sections, eight series, and seven subseries.

Eleocharis subser. *Truncatae* Svenson is strictly an American group belonging to subgenus *Eleocharis*, section *Eleocharis*, series *Eleocharis* (González-Elizondo & Peterson, 1997), and is currently in need of revision throughout its range (Smith et al., 2002; González-Elizondo & Reznicek, 2005). *Eleocharis* subser. *Truncatae* is distinguished by its truncate, indurate upper sheaths with a sometimes prominent tooth or apiculate projection and its trigonous achenes (Svenson, 1929; González-Elizondo & Peterson, 1997). In Mexico, subseries *Truncatae* is currently represented by ca. 10 species (McVaugh, 1993; Espejo Serna & López Ferrari, 1997; Strong & González-Elizondo, 2000) and includes a taxonomically difficult species complex involving *E. montevidensis* Kunth and its many forms, allied species (e.g., *E. dombeyana* Kunth, *E. ignota* S. González & Reznicek), and several undescribed taxa (González-Elizondo & Reznicek, 2005; González-Elizondo, pers. comm.).

Recent study of material belonging to subseries *Truncatae* collected during a field trip in the Mexican state of Durango has led to the discovery of a remarkably distinct, yet undescribed species.

Eleocharis gonzaleziae D. J. Rosen, sp. nov. TYPE: Mexico. Durango: Mpio. Durango, W of roadside of MEX Hwy. 23, betw. Mezquital & Durango, ca. 26 km S of Durango, 23°53′08.2″N, 104°30′01.8″W, 1845 m, 16 Sep. 2005, *D. J. Rosen 3507 with S. González-Elizondo, R. Carter, R. Guaglianone, P. Peterson, A. Torres* (holotype, CIIDIR; isotypes, MICH, MO, TAES, TEX, VSC, WIS). Figure 1.

Haec species *Eleochariti bolanderi* A. Gray simillima, sed ab ea culmis elatis, vaginis foliaribus distalibus dente conspicuo instructis, spiculis angustioribus, squamis angustioribus pallidioribus et acheniis minoribus differt.

Perennial, densely tufted; roots fine, fibrous, mostly drab brown; rhizomes caudex-like, mostly hidden by culms and roots, short, 2.1–2.8 mm diam., hard, cortex persistent, internodes very short, scales not evident. *Culms* subterete, often prominently blunt-ridged when dry, 31–41.5 cm × 0.5–0.6 mm, internally spongy, light green, fragile and brittle when dry. Distal leaf sheaths persistent, not splitting, proximally brown, pinkish, or stramineous, distally stramineous, longitudinally ridged, apex truncate, callose, brown-tinged, prominent tooth present, the free portion 0.4–

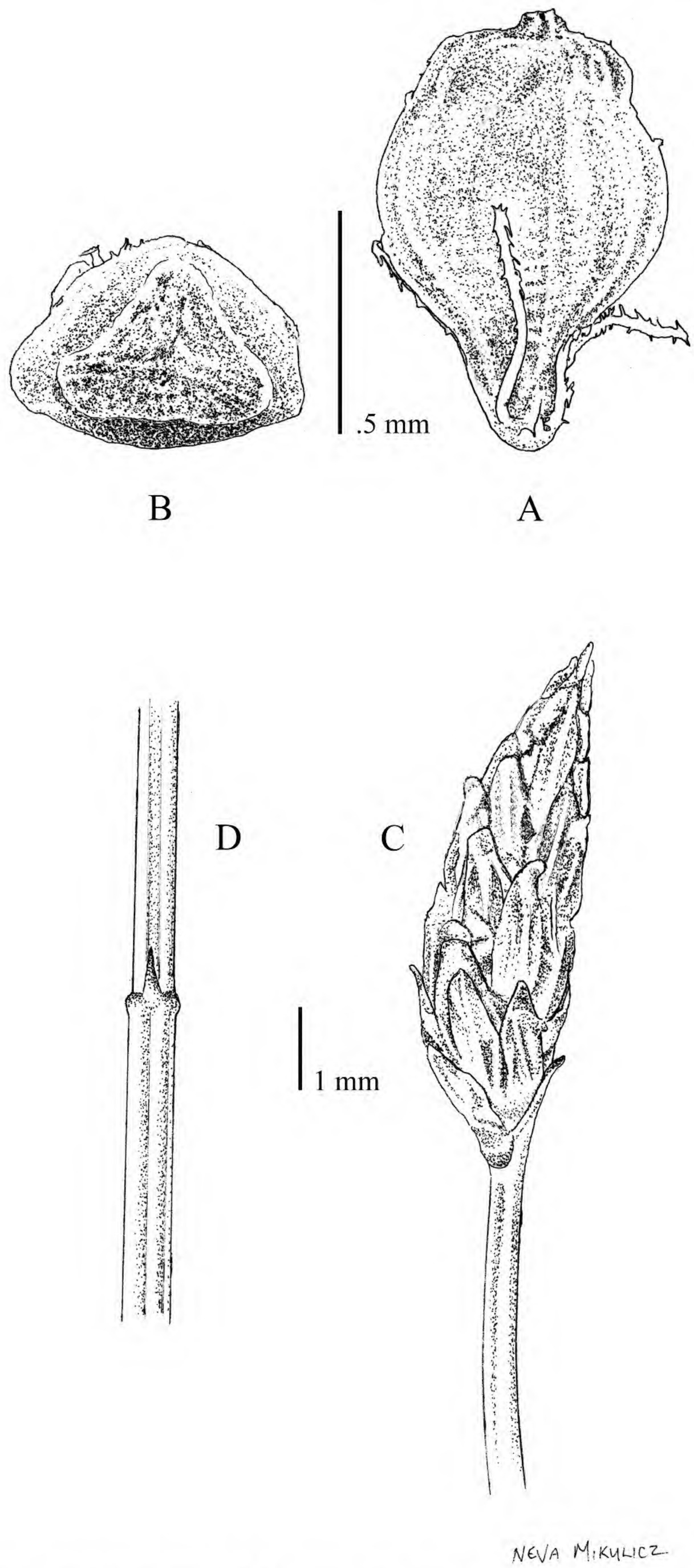

Figure 1. *Eleocharis gonzaleziae* D. J. Rosen. —A. Achene (abaxial view). —B. Achene (apical view). —C. Spikelet. —D. Leaf sheath summit. Drawn from the holotype *D. J. Rosen 3507* (CIIDIR).

0.6 mm long. *Spikelets* ovoid, 5–7 × 1.2–1.5 mm, apex acute; proximal scale persistent and amplexicaulous, entire, broadly rounded, the distal portion hyaline-erose; subproximal scale with flower; remaining floral scales loose, ascending in fruit, midrib regions stramineous, marginally dark purplish to dark brown, ovate to lanceolate, 1.7–2.3 × 0.8–0.9 mm, apex entire, acute, hyaline. *Flowers* with perianth

Table 1. Morphological comparison of *Eleocharis gonzaleziae* and *E. bolanderi*.

Characters	*E. gonzaleziae*	*E. bolanderi*
Culm height (cm)	31–41.5	10–30
Distal leaf sheath tooth	present	absent
Spikelet width (mm)	1.2–1.5	2–3
Floral scale width (mm)	0.8–0.9	1.5
Floral scale color	stramineous, marginally dark purplish to dark brown	dark brown to blackish, midrib stramineous or greenish
Achene dimensions (mm)	0.8–0.9 × 0.5–0.6	0.9–1.2 × 0.7–0.8

bristles 3 to 6, retrorsely spinulose nearly to the base, white to stramineous, slender, often unequal, from rudimentary to 0.6–0.8× achene length; stamens 3; anthers dark yellow, 0.7–1 mm; styles 3-fid. *Achenes* falling with scales, stramineous, smooth or only very finely cancellate even at high magnification, obovoid, abaxial angle prominent to obscure, 0.8–0.9 × 0.5–0.6 mm, apex broadly truncate, green-tinged. *Tubercles* stramineous to brown, sunken with a central apiculus, wider than long, often 3-lobed, 0.05–0.2 × 0.3–0.4 mm.

Habitat and distribution. *Eleocharis gonzaleziae* grows mixed with other species of *Eleocharis* in standing water in deep soils at 1845 m above sea level. It is possibly an endemic of the Mexican Plateau region in the state of Durango and is currently known only from the type collection.

IUCN Red List category. Fieldwork in 2007, in the region of the type locality, failed to yield discovery of any additional populations of *Eleocharis gonzaleziae*. For now, it seems sufficient to assign a conservation status as DD (Data Deficient) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The name of the species is dedicated to my generous colleague, friend, and sedge authority, M. Socorro González-Elizondo, founder and Curator of the Herbarium, CIIDIR Unidad Durango, Instituto Politécnico Nacional.

Relationships. *Eleocharis gonzaleziae* most closely resembles *E. bolanderi* A. Gray of the northwestern United States. Previous reports of *E. bolanderi* (as *E. montevidensis* var. *bolanderi* (A. Gray) V. E. Grant) by Espejo Serna and López Ferrari (1997) from Mexico are based on specimens of *E. montevidensis* s.l. with thick rhizomes (González-Elizondo, pers. comm.). *Eleocharis gonzaleziae* differs from the other slender-culmed species of subseries *Truncatae* in the Mexican high plateau in having achenes with a broadly truncate apex and a sunken, apiculate tubercle. Table 1 provides a comparison of characters between *E. gonzaleziae* and the morphologically similar *E. bolanderi*.

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Ruellia saccata, a New Species of Acanthaceae from Bolivia

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Abstract. *Ruellia saccata* Schmidt-Lebuhn & E. Tripp, a new species of Acanthaceae from Beni, Bolivia, with a highly distinctive corolla morphology, is described as new to science. The novelty resembles and is related to *R. brevifolia* (Pohl) C. Ezcurra, but differs in the presence of a pronounced corolla pouch, a longer corolla with a narrower orifice, and a spreading to procumbent habit. Its differences from and similarities to other species in the genus are also discussed, and an updated key to the red-flowered Bolivian species of *Ruellia* L. is presented.

Resumen. *Ruellia saccata* Schmidt-Lebuhn & E. Tripp, una nueva especie de Acanthaceae de Beni, Bolivia, que tiene una corola morfológicamente muy distintiva, es descrita como nueva para la ciencia. La nueva especie se asemeja y está relacionada a *R. brevifolia* (Pohl) C. Ezcurra, pero se distingue por tener una corola más larga con un orificio más estrecho y una bolsa pronunciada en la misma, así como por presentar un hábito extendido y procumbente. Las diferencias y semejanzas de la nueva especie a otras en el género también son discutidas, y una clave actualizada para las especies bolivianas de *Ruellia* L. de flores rojas es presentada.

Key words: Acanthaceae, Andes, Bolivia, hummingbird pollination, IUCN Red List, *Ruellia*, Ruellieae, Ruellioideae, South America.

The genus *Ruellia* L. (Acanthaceae), with ca. 300 species, is particularly diverse in regions of western South America that host an impressive diversity of hummingbirds. It has been suggested that the diversification of some 330 species of hummingbirds began between 12 and 17 million years ago (Ma) and was partly driven by the Andean uplift (Bleiweiss, 1998a). This hummingbird diversity probably helps to explain species richness in some groups of plants (Bleiweiss, 1998b). One lineage in the Physiruellia clade of *Ruellia* (sensu Tripp, 2007; section *Physiruellia* Lindau) may be such an example. Centered on the widespread and morphologically variable *R. brevifolia* (Pohl) C. Ezcurra, this lineage contains at least 40 species (Ezcurra, 1989) that are distributed across portions of eastern Brazil, northern Argentina, Paraguay, Uruguay, Bolivia, Peru, Ecuador, and Colombia. A large portion of the species in this lineage, including the new taxon we discuss below, is adapted to pollination by hummingbirds. Among these species are *R. chartacea* (T. Anderson) Wasshausen, *R. gracilis* Rusby, *R. haenkeana* (Nees) Wasshausen, *R. longipedunculata* Lindau, *R. pearcei* Rusby, *R. ruiziana* (Nees) Lindau, and *R. sanguinea* Grisebach. Although species in this clade are morphologically distinguishable by both vegetative and floral traits, they show little genetic divergence, suggesting that the lineage may be young in age. A simple molecular clock approach estimated the most recent common ancestor of *Ruellia* to be approximately 9–14 Ma (Tripp, 2007), thus the age of this particular lineage may be even younger. It seems plausible that a mutualistic relationship with hummingbird pollinators, in combination with the Andean orogeny and other geological and climatological events, may have led to some level of diversification in one or both groups of organisms.

During fieldwork in 2000, a population of a red-flowered *Ruellia* was discovered on the flank of a hill directly south of the Bolivian town of Rurrenabaque. The plants were initially identified as *Ruellia* cf. *brevifolia*, as this species is known to be common, widely distributed, morphologically variable, and shows the herbaceous habit of and approximately the same corolla size as the new population. Closer examination, however, revealed several striking differences from *R. brevifolia*, particularly in corolla morphology and growth form. Even though recent, regional taxonomic treatments are available for the genus in Bolivia as well as some surrounding areas (Ezcurra, 1993a, b; Wasshausen & Wood, 2003,

2004), the newly discovered plant was not among species known from Bolivia or other countries of southern South America. After a revision of the relevant literature and some 1000 specimens of *Ruellia* available to the second author, we concluded that the plant represented a new, undescribed species. The present paper describes the novelty and discusses its presumed relationships to other species of the genus.

Ruellia saccata Schmidt-Lebuhn & E. Tripp, sp. nov. TYPE: Bolivia. Dept. Beni: José Ballivián Prov., abajo de una colina directo al sur de Rurrenabaque, 14°27′S, 67°32′W, 250 m, 8 Sep. 2000, *A. N. Schmidt-Lebuhn 60* (holotype, LPB; isotypes, GOET, US). Figures 1, 2.

Haec species *Ruelliae brevifoliae* (Pohl) C. Ezcurra affinis, sed ab ea corollis ventraliter saccatis 23–30 mm longis ad orificium constrictioribus et habitu procumbente differt.

Perennial herb to ca. 50 cm tall; stems weakly erect, soon spreading horizontally and ± procumbent, internodes 3–9 cm, glabrous. Leaves petiolate; margins subentire to weakly crenulate; petioles 0.5–2.5 cm, moderately pilose with white, untidily curved trichomes to 1 mm; leaf blades ovate, 3.5–9.5 × 1.5–4.5 cm, ca. 1.5–2.5× as long as wide, base broadly attenuate to rounded, apex attenuate, adaxially glabrous, abaxially glabrous except for scattered, straight, white trichomes along the veins and margins, these to ca. 0.25 mm, cystoliths on both leaf surfaces, these simple, slender, ca. 0.2–0.5 mm; secondary veins 5 to 8 on each side of the midrib, arching toward the apex, clearly visible especially abaxially. Inflorescences of cymes in the axils of leaves, only 1 per node of the main axis; peduncles 5–10 cm; pedicels of subcymes ca. 0.3–2.3 cm; inflorescences consisting of up to 10 flowers, peduncles and pedicels moderately pilose with somewhat untidily oriented, straight, white trichomes up to ca. 0.25 mm; bracteoles linear, 1-veined, 2–10 × 0.5–1 mm, pedicels 2–4 mm, densely pubescent with straight, white trichomes up to 0.1 mm. Flowers with calyces of 5 sepals, these green, subulate, 1-veined, 7–9 mm, basally connate, with the lobes 6–7.5 mm long, sepals densely pubescent with straight, white trichomes up to ca. 0.1 mm, mostly eglandular with a few glandular; corollas 23–30 mm, red, ventricose, moderately pubescent with straight trichomes and stalked glands to 0.2 mm, the narrow unexpanded portion of corolla tube curved, 5–6 × 1–2 mm, the expanded throat slightly curved, 15–20 mm, its basal portion inflated to 12 mm with a pronounced ventral nectar-bearing saccus or pouch, throat constricted to 4–5 mm at the orifice, lobes emarginate, subequal, 2–3 × ca. 2 mm, appearing as a continuation of the throat; stamens with 1 pair to 1 mm longer than the other, filaments ca. 27–29 mm, basally connate in pairs, with downward-pointing, mostly eglandular trichomes, these sparser to nearly glabrous on apical portions, some flowers with a dorsal staminode (i.e., representing a fifth stamen), adnate to corolla ca. 0.5 mm above filament fusion, staminode to 15 mm, glabrous, fused filament sheath (curtain) adnate and enclosing nearly all of unexpanded portion of tube; anthers 2-thecous with equal, parallel thecae, purple, 2.5–3 × ca. 0.6 mm, level with the orifice of the corolla or exserted to 5 mm, connective tissue of thecae glandular with very shortly stalked glands, pollen (Fig. 2) with reticulate exine, ca. 70 µm diam.; ovaries densely puberulent and sparsely glandular with shortly stalked glands on the uppermost portion; styles purple, 30–32 mm, sparsely pubescent with straight trichomes and stalked glands ca. 0.1 mm, stigma bifid, ventral lobe ca. 0.5 mm longer than dorsal lobe; capsules club-shaped, green with a dark reddish tinge at the tip and along the sutures when maturing, light brown when mature, ca. 12–16 mm, the sterile portion ca. 5–8 × 1–2 mm, the seed-bearing portion ca. 7–8 × 3–4 mm, apex attenuate; ovules 12 per capsule; seeds dark brown, flat, ca. 2–2.5 mm diam., with hygroscopic trichomes restricted to the margins.

Distribution. Currently, only one population located on the western flank of a hill directly south of Rurrenabaque is known. Due to the inaccessibility of the site, little can be said about population size both in terms of number of individuals and area. At most, a few dozen plants were observed clustered in patches along part of the path, but it is conceivable that the population extends to inaccessible parts of the cliff, or even that more populations could be found in other parts of the poorly explored hill ranges on both sides of the Río Beni.

Ecology. The plants occupy very steep slopes and cliffs along a path following the water pipeline supplying Rurrenabaque, frequently rooting in cracks on the rocky cliff surface. The area is moist throughout the year, and the surrounding forest is semi-deciduous to evergreen. Conditions are relatively shady due to tree cover, but the plants seem to have an affinity for light gaps. Flowering time is at the end of the dry season, which extends from late May to September at the type location. Although no direct pollinator observations have been made, the shape, size, and brilliant red color of the corolla suggest that the plants may be adapted to pollination by hummingbirds. A nectar sample from *Ruellia saccata* included in a previous study (Schmidt-Lebuhn et al., 2007; as "*R.* aff. *brevifolia*") was relatively dilute with a concen-

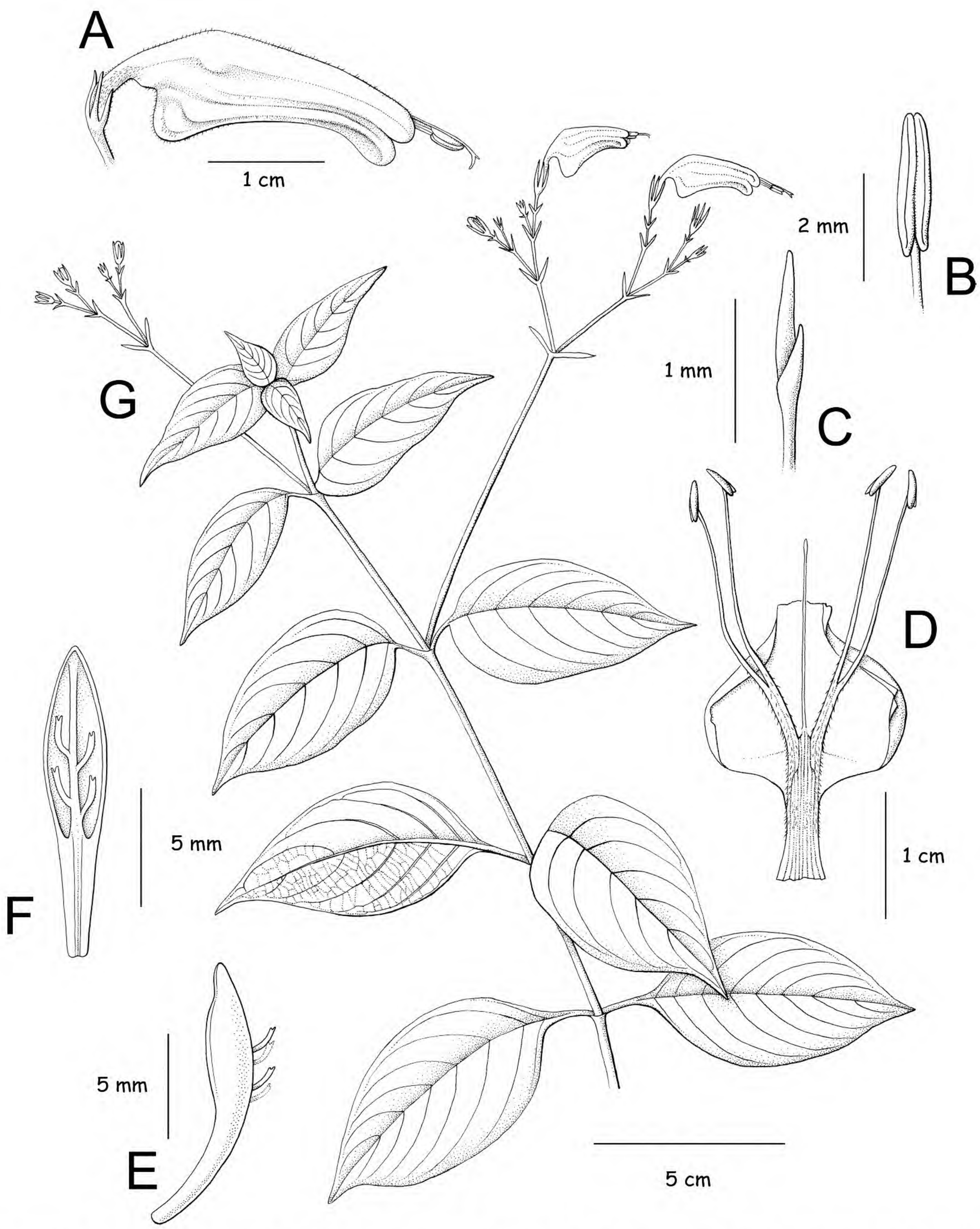

Figure 1. *Ruellia saccata* Schmidt-Lebuhn & E. Tripp. —A. Corolla. —B. Anther. —C. Stigma. —D. Internal corolla surface shown with staminode (but note most corollas thus far examined are without staminodes). —E. External surface of capsule. —F. Internal surface of capsule showing one half of each of two locules. —G. Whole plant. Illustration by Amanda Labadie, drawn from the isotype *A. N. Schmidt-Lebuhn 60* (US) and a corolla photograph of a live specimen taken at the type locality.

tration of 15 g/100 ml and contained mostly sucrose (70%), thus showing a composition observed in many trochilophilous (hummingbird-pollinated) species.

IUCN Red List category. Due to the low number of plants observed at the type locality, only one specimen was collected, thus no paratypes exist. The new species is therefore assigned a conservation status as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The specific epithet describes the conspicuous, pouched protrusion or saccus evident at the base of the corolla throat.

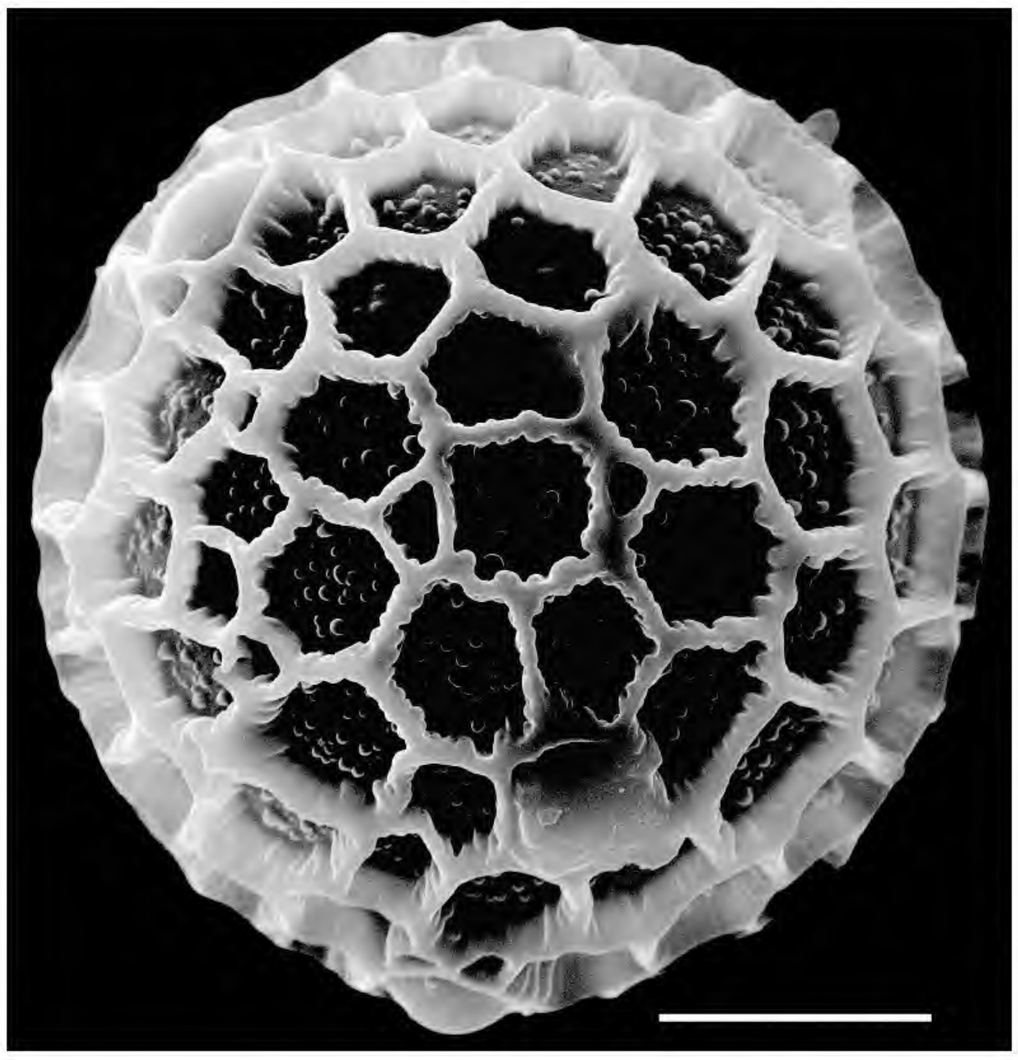

Figure 2. SEM image of pollen from *Ruellia saccata*. Scale bar = 20 μm.

Discussion. *Ruellia saccata* is notably similar to the widely distributed and variable *R. brevifolia*. Both species share the ventricose corolla with a very narrow basal tube and inflated throat, but the novelty is distinct by its pronounced ventral pouch and more constricted orifice (Fig. 1). In addition to corolla shape, *R. saccata* differs from *R. brevifolia* by its procumbent growth (vs. erect) and longer corollas (23–30 mm vs. usually up to 20 mm). The tendency of the new species to grow horizontally is likely an adaptation to its habitat—the steep, rocky hillside that hosts the only population known to date.

Molecular data (E. Tripp, unpublished data) place *Ruellia saccata* in the highly derived and unresolved clade that is centered around *R. brevifolia* (Physiruellia clade; Tripp, 2007). In addition to molecular data, species in the Physiruellia clade of *Ruellia* are characterized by seeds with hygroscopic trichomes that are restricted to the margins (vs. covering the entire seed surface; Ezcurra, 1993b; Tripp, 2007). *Ruellia saccata* morphologically resembles other closely related species in this clade, including *R. gracilis*, *R. pearcei*, and *R. ruiziana*, especially with regard to herbaceous growth form and approximate corolla dimensions, color, and shape, especially the reduced lobes. It is again distinguished from these three species (and other red-flowered Bolivian *Ruellia*) by its remarkable corolla pouch as well as other features identified in the key below. The highly specialized corolla, with a very restricted orifice and the nectar-bearing pouch, is to our knowledge unique among New World *Ruellia*.

Another extraordinary feature observed in some flowers of *Ruellia saccata* is the occasional presence of a staminode that occupies the dorsalmost position in the flower and represents the fifth member of this whorl. It has been observed in two of 20 examined flowers. The presence of a staminode is remarkable in that most other species of *Ruellia* examined to date are known to have only four stamens (see Nees, 1847a, b; also, staminodes were recently discovered in multiple flowers in a population of *R. bourgaei* Hemsley in Jalisco, Mexico; see *E. A. Tripp & C. Kiel 428* [RSA]). Staminodes are known from some of the remaining ca. 47 genera in tribe Ruellieae (e.g., see Wood, 1995, and Deng et al., 2006, for examples of staminodes in *Strobilanthes* Blume). Staminodes are known and can be common elsewhere in the family, in lineages outside of Ruellieae (McDade et al., 2000).

The key to (red-flowered) Bolivian *Ruellia* from Wasshausen and Wood (2004) is altered below to accommodate the novelty.

1a. Corolla (excluding lobes) 41–60 mm; lobes > 5 mm 2
1b. Corolla (excluding lobes) up to 40 mm; lobes < 5 mm 3
2a. Corolla tube very gradually expanding from base, widest at opening of mouth; plant an erect perennial . . . . . *R. haenkeana*
2b. Corolla tube abruptly expanding from base, widest in middle; plant a scrambling or vining perennial . . . . . *R. inflata* Richard
3a. Flowers solitary and subsessile or on short, leafy peduncles . . . . . *R. sanguinea*
3b. Flowers borne on richly branched, axillary peduncles that are devoid of leaves or leaflike bracts 4
4a. Leaves narrowly lanceolate to linear, < 1 cm wide . . . . . *R. gracilis*
4b. Leaves broadly oblong, ovate, or lanceolate, at least 2 cm wide 5
5a. Calyx lobes glabrous, oblong-lanceolate, usually > 10 mm at anthesis . . . . . *R. longipedunculata*
5b. Calyx lobes pubescent or glabrous, long attenuate from base, < 10 mm at anthesis 6
6a. Corolla 31–40 mm, gradually widened from base; leaves narrowly oblong-elliptic, often violet abaxially . . . . . *R. pearcei*
6b. Corolla up to 30 mm, abruptly widened from a shortly cylindrical base; leaves variable but commonly ovate or elliptic, not violet abaxially 7
7a. Plants weakly erect, spreading horizontally to procumbent; corolla clearly saccate, 23–30 mm . . . . . *R. saccata*
7b. Plants erect; corolla not saccate, rarely the back of the throat somewhat convex in *R. brevifolia*, < 20(–25) mm 8
8a. Leaves densely pubescent, at least 5 cm wide; inflorescence hirsute . . . . . *R. ruiziana*
8b. Leaves glabrous to weakly pubescent, < 5 cm wide; inflorescence glabrous to weakly pubescent . . . . . *R. brevifolia*

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La Sect. *Obtusifolii* del Género *Lonchocarpus* (Leguminosae, Papilionoideae, Millettieae) para Mesoamérica

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Resumen. Se tratan las especies de *Lonchocarpus* Kunth sect. *Obtusifolii* (Bentham) M. Sousa (Leguminosae, Papilionoideae, Millettieae) para Mesoamérica. De las 12 especies reconocidas, cinco son nuevas para la ciencia, *L. canoensis* M. Sousa, *L. foveolatus* M. Sousa, *L. paucinervius* M. Sousa, *L. sylvicola* M. Sousa y *L. velizii* M. Sousa, se describen e ilustran. Las especies mesoamericanas de la sección se contrastan en una clave. Se lectotipifica la ser. *Obtusifolii* Bentham con *L. rugosus* Bentham, se hace una nueva combinación y la serie se eleva de rango a sección. La sect. *Obtusifolii* se caracteriza y diferencia de la sect. *Densiflori* Bentham. De cada uno de los taxones tratados se hizo una valoración del grado de conservación (IUCN).

Abstract. A revision of the species of *Lonchocarpus* Kunth sect. *Obtusifolii* (Bentham) M. Sousa (Leguminosae, Papilionoideae, Millettieae) is presented for Mesoamerica. Of the 12 recognized species, five that are new to science, *L. canoensis* M. Sousa, *L. foveolatus* M. Sousa, *L. paucinervius* M. Sousa, *L. sylvicola* M. Sousa, and *L. velizii* M. Sousa, are here described and illustrated. The Mesoamerican species are compared in a key. The series *Obtusifolii* Bentham is lectotypified with *L. rugosus* Bentham, and a new combination is made elevating the series to sectional rank. Section *Obtusifolii* is characterized and distinguished from section *Densiflori* Bentham. Assessments of the conservation status (IUCN) are made for each taxon.

Key words: IUCN Red List, Leguminosae, *Lonchocarpus*, Mesoamerica, sect. *Obtusifolii*.

El género *Lonchocarpus* Kunth (Leguminosae, Papilionoideae, Millettieae) comprende alrededor de 180 especies de los trópicos de América, con una especie en las costas occidentales de África ecuatorial. La sect. *Obtusifolii* (Bentham) M. Sousa incluye alrededor de 27 especies; Mesoamérica con 12, de las cuales 11 son endémicas; México (en el área fuera de la región mesoamericana) con 11, de las cuales 10 son endémicas; Sudamérica con sólo cinco, de las cuales cuatro son endémicas.

Pittier (1917) propuso la ser. *Impressinervi* Pittier, que caracterizó en su clave, la cual corresponde muy bien a un grupo más o menos bien definido de especies de *Lonchocarpus*; pero no necesariamente todas las especies que Pittier incluyó. Desafortunadamente, Pittier ubicó mal las series y secciones que propuso, invirtiéndolas en su revisión, al colocarlas en un rango superior o inferior al que deberían corresponder, y siendo ambos rangos secundarios, según McNeill et al. (2006: Art. 4.1), no se consideran válidamente publicadas (Art. 33.9 y 33.10). Pittier (op. cit.) incluyó en su ser. *Impressinervi* dos secciones, *Philenopteri* Pittier y *Spongopteri* Pittier, que consecuentemente, también no fueron válidamente publicadas. Bentham (1860) propuso la ser. *Obtusifolii*, que aquí elevamos de rango a sección, para incluir a este grupo, al no poder usar los nombres propuestos por Pittier.

Tratamiento Taxonómico

Lonchocarpus sect. **Obtusifolii** (Bentham) M. Sousa, comb. et stat. nov. Basiónimo: *Lonchocarpus* ser. *Obtusifolii* Bentham, J. Linn. Soc., Bot. 4 (Suppl.): 86. 1860. Lectotipo aquí designado: *Lonchocarpus rugosus* Bentham, J. Linn. Soc., Bot. 4 (Suppl.): 92. 1860.

Bentham (1860) propuso la ser. *Obtusifolii* dentro de la sect. *Densiflori* Bentham, y aquí elevamos la serie *Obtusifolii* a sección. En la ser. *Obtusifolii*, Bentham ubicó a dos especies, *Lonchocarpus rugosus* Bentham y *L. obovatus* Bentham. De ellas, aquí se escogió como lectotipo a *L. rugosus*, ya que *L. obovatus* pertenece a la sect. *Eriophylli* Bentham, lectotipificada por Pittier (1917) y caracterizada por Sousa (1992).

La sect. *Obtusifolii* se caracteriza por: corteza interior que frecuentemente no exuda resina rojiza al corte, en ocasiones sí; hojas con arreglo helicoidal en el tallo; estípulas más largas que anchas, grandes, generalmente patentes a reflexas, frecuentemente persistentes; hojas pelosas, epunteadas, en ocasiones foveoladas; folíolos con el ápice obtuso a emarginado, en ocasiones acuminados, nervaduras frecuen-

temente realzadas, camptódromas o craspedódromas; brácteas y bractéolas alargadas, las bractéolas lejanas al cáliz sobre el pedicelo, generalmente opuestas, en ocasiones alternas. Flores con mecanismo floral valvar; cáliz lobado, ligeramente zigomorfo, peloso; corola pelosa, generalmente epunteada, raramente translúcido linear-punteada, las alas con sus ápices patentes, respecto a la quilla. Legumbres indehiscentes, los márgenes aquillados a nervados, sin alas ni surcos. Plántulas frecuentemente con los cotiledones epigeos, en ocasiones hipogeos; eofilos (1)3- a 5-foliolados, opuestos, en un caso catafilos alternos.

La sect. *Obtusifolii* es cercana a la sect. *Densiflori* Bentham, sección lectotipificada y caracterizada por Sousa (2005). Ambas secciones difieren por los siguientes caracteres:

1a. Folíolos generalmente con el ápice acuminado a agudo, en ocasiones obtuso; nervación siempre camptódroma nunca craspedódroma; ovario 2- a 4(5)-ovulado; legumbres con el margen vexilar aquillado a alado, en ocasiones ligeramente surcado; plántulas con los cotiledones siempre hipogeos, eofilos 1-foliolados, opuestos . . . . sect. *Densiflori*

1b. Folíolos generalmente con el ápice obtuso a emarginado, en ocasiones acuminado; nervación camptódroma o craspedódroma; ovario (2)4- a 8(10)-ovulado; legumbre con el margen vexilar aquillado a nervado, sin alas ni surcos; plántulas frecuentemente con los cotiledones epigeos, en ocasiones hipogeos, eofilos (1)3- a 5-foliolados, opuestos, en un caso, catafilos alternos. . . . . sect. *Obtusifolii*

Clave para las Especies de la sect. *Obtusifolii* en Mesoamérica

1a. Folíolos con las nervaduras secundarias rectas y resolviéndose hasta el margen (craspedódromas).
- 2a. Órganos vegetativos con pelosidad largo-pilosa con tricomas hasta 1.4 mm de largo; estípulas 13–15 × 2–3 mm (en la base) de ancho; hojas 9- a 11-folioladas; legumbres hasta 21 cm de largo. . . . . 9. *L. pilosus* M. Sousa
- 2b. Órganos vegetativos sin pelosidad largo-pilosa; estípulas 4–6 mm de largo; hojas (3)5- a 7-folioladas, legumbres hasta 13 cm de largo.
  - 3a. Folíolos (1.5–)3.5–7(–9) × (1–)2–3.5(–5.5) cm; nervaduras laterales 14 a 23; flores 9–10 mm de largo . . . . . 8. *L. phlebophyllus* Standley & Steyermark
  - 3b. Folíolos 6–12(–14.5) × 4–8 cm; nervaduras laterales 9 a 13; flores 13–15 mm de largo . . . . . 3. *L. costaricensis* (Donnell Smith) Pittier

1b. Folíolos con las nervaduras secundarias curvadas y resolviéndose casi paralelamente hasta cerca del margen (camptódromas).
- 4a. Ápices de los folíolos acuminados a caudados, los márgenes generalmente aplanados.
  - 5a. Estípulas 6–7 mm de largo, semipersistentes; nervaduras secundarias 15 a 17; pedicelos 3–4 mm de largo; bractéolas 1.5–2 mm de largo; flores 10–12 mm de largo, la lámina del estandarte 11–13 mm de ancho; ovario 6- a 7-ovulado . . . . . 6. *L. lasiotropis* F. J. Hermann
  - 5b. Estípulas 0.4–0.5 mm de largo, pronto caducas; nervaduras secundarias 9 a 11; pedicelos 1.7–2 mm de largo; bractéolas 0.3–0.4 mm de largo; flores 9–10 mm de largo, la lámina del estandarte 7.5–8 mm de ancho; ovario 3- a 5-ovulado . . . . . 11. *L. sylvicola* M. Sousa
- 4b. Ápices de los folíolos obtusos a emarginados, los márgenes generalmente revolutos.
  - 6a. Órganos vegetativos con pelosidad largo pilosa con tricomas hasta 2 mm de largo.
    - 7a. Hojas 9- a 21(27)-folioladas, nervaduras foliares terciarias realzadas en el haz e impresas en el envés; estípulas (4–)6–15(–19) mm de largo. . . . . 10. *L. rugosus* Bentham
    - 7b. Hojas 7- a 9-folioladas, nervaduras foliares terciarias no realzadas en el haz ni impresas en el envés; estípulas 4–5 mm de largo . . . . . 7. *L. paucinervius* M. Sousa
  - 6b. Órganos vegetativos sin pelosidad largo pilosa.
    - 8a. Legumbres (2.1–)2.5–3.2 cm de ancho, glabras . . . . . 2. *L. castilloi* Standley
    - 8b. Legumbres 1.4–1.9 cm de ancho, pelosas.
      - 9a. Folíolos 1.5–2.4(–2.6) cm de ancho; flores ca. 6 mm de largo . . . . . 12. *L. velizii* M. Sousa
      - 9b. Folíolos 0.6–1.6 cm de ancho; flores 7–11 mm de largo.
        - 10a. Hojas (13)15- a 19-folioladas, folíolos foveolados en el envés . . . . 4. *L. foveolatus* M. Sousa
        - 10b. Hojas 5- a 11-folioladas, folíolos sin fovéolas.
          - 11a. Inflorescencias densifloras; floración tardía; flores 10–11 mm de largo; legumbres aplanadas, tomentosas . . . . . 1. *L. canoensis* M. Sousa
          - 11b. Inflorescencias paucifloras; floración de coetáneas a tardía; flores 7–9 mm de largo; legumbres con las valvas abombadas a la altura de las semillas, velutinas . . . . . 5. *L. fuscopurpureus* Brandegee

1. Lonchocarpus canoensis M. Sousa, sp. nov. TIPO: Honduras. Francisco Morazán: Mpio. Tegucigalpa, Río Las Canoas, 2.5 km del Tablón, 14°02′N, 89°10′O, 1020 m, 18 sep. 1996, *J. Linares 3507* (holotipo, MEXU; isotipos, EAP, MEXU). Figura 1.

Haec species *Lonchocarpo hidalgensi* Lundell proxima, sed ab eo foliorum foliolis paucioribus (7 ad 9[ad 11] vs. 11 ad 19), vexilli lamina adaxialiter dense (vs. sparsim vel modice) sericea trichomatibus brunneo-luteolis et legumine minore (3.5–4.2 × 1.5–1.7 cm vs. 5.2–8.5 × 1.8–2 cm) differt.

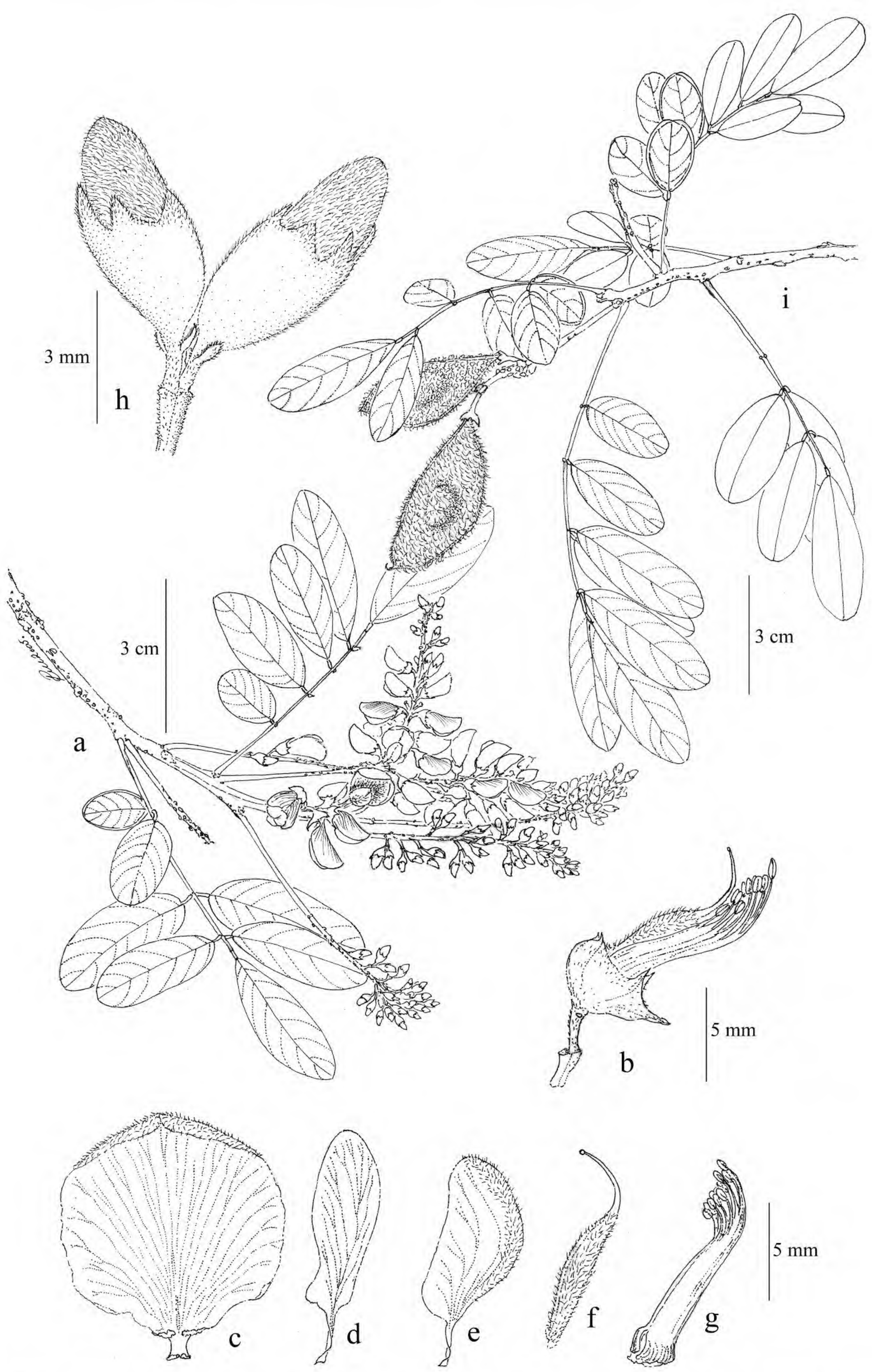

Figura 1. *Lonchocarpus canoensis* M. Sousa. —A. Rama con hojas e inflorescencias. —B. Cáliz con tubo estaminal y gineceo. —C. Estandarte. —D. Ala. —E. Quilla. —F. Gineceo. —G. Tubo estaminal. —H. Unidad biflora de la inflorescencia, mostrando botones florales y bractéolas. —I. Rama con hojas e infrutescencias. (A–H de *Linares 3507*; I de *Linares 4066 A.*)

Árboles ca. 5 m; corteza interior sin producir fluido resinoso al corte; ramas moderadamente ferrugíneo-tomentulosas, pronto glabrescentes. Hojas con arreglo helicoidal en el tallo; estípulas 1.3–1.5 × ca. 0.8 mm (en la base), triangular-atenuadas, erectas, pronto caducas; pecíolo 1.2–2.5 cm, canaliculado; hojas 7- a 9(11)-folioladas, folíolos (1.5–)2.2–3.7(–4.7) × (0.8–) 1.1–1.4(–1.6) cm, elípticos a angostamente oblongo-elípticos en ocasiones angostamente obovados, la base obtusa a redondeada, frecuentemente cuneada, algo asimétrica, los márgenes revolutos, el ápice obtuso a redondeado, subcoriáceos, foveolados con puntuaciones translúcidas, en el haz glabros y foveolados, en el envés moderadamente pardo-amarillento tomentuloso a tomentosos sobre las nervaduras; nervación camptódroma, nervaduras primaria y secundarias impresas en el envés, las nervaduras laterales 9 a 10. Inflorescencias 5–7 cm, paniculadas, en ocasiones simples y axilares, densifloras, floración tardía, pedunculadas; pedúnculo floral 1.5–2 mm; pedicelos 1.8–2.5 mm; bractéolas 0.8–1 mm, lanceoladas, opuestas, del 1/3 superior al ápice del pedicelo. Flores 10–11 mm; cáliz ca. 2.5 mm, densamente marrón-cobrizo seríceo, epunteado, zigomorfo, el diente central carinal ca. 1.5 mm, triangular-agudo; corola púrpura, epunteada, la lámina del estandarte ca. 9 mm de ancho, orbicular, moderada a densamente pardo-amarillento sericea adaxialmente, glabra abaxialmente; ovario 5(6)-ovulado. Legumbre 3.5–4.2 × 1.5–1.7 cm, elíptica, indehiscente, atenuada en la base, obtusa y rostrada en el ápice, lateralmente compresa, cartácea, densamente pardo-amarillento tomentosa, margen vexilar nervado, el carinal angostamente aquillado; semillas (inmaduras) 1 por fruto.

Distribución y hábitat. Esta especie se localiza en Honduras, en la cuenca alta del Río Choluteca, siendo el Río Las Canoas uno de sus afluentes, drena al Golfo de Fonseca. Ripario en selvas bajas caducifolias con vegetación circundante de bosques de encinos y pinares. Esta especie vive en altitudes alrededor de 1020 m.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus canoensis* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie sólo conocida de un área muy restringida.

Fenología. La floración ocurre a mediados de septiembre y la fructificación a inicios de diciembre.

Etimología. El epíteto hace énfasis en la localidad de la cual, sólo se conoce.

Discusión. *Lonchocarpus canoensis* es cercana a *L. hidalgensis* del oriente de México, pero en *L. hidalgensis* sus hojas cuentan con un mayor número de folíolos (11 a 19), en la lámina del estandarte su pelosidad es menos densa, más bien rala adaxialmente, y sus frutos más grandes (5.2–8.5 × 1.8–2 cm).

Paratipo. HONDURAS. **Francisco Morazán:** Mpio. Tegucigalpa, margen del Río Las Canoas, ca. 5 km al O de Tegucigalpa, 14°02′N, 87°10′O, *J. L. Linares, C. A. Martínez y F. Hubbard 4066A* (MEXU).

2. Lonchocarpus castilloi Standley, Trop. Woods 32: 15. 1932. TIPO: Belice. Stann Creek: Freshwater Creek Reserve, *A. Castillo 30* (holotipo, F).

Ilustración: Pennington y Sarukhán, 2005: 257.

Especie maderable de extenso uso, muy característica por sus frutos anchos y glabros, además de sus plántulas con cotiledones hipogeos, con los primeros eofilos alternos reducidos a catafilos.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus castilloi* debe considerarse como: casi amenazado (NT), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie que a pesar de que es ampliamente explotada, cuenta con buena regeneración y es relativamente abundante.

Material representativo. BELICE. **Cayo:** *C. L. Lundell 6490* (DS, GH, MEXU, MICH, MO, NA, TEX, VT). **Corozal:** *M. Sousa et al. 4148* (MEXU), *P. H. Gentle 476* (GH, MICH). **Stann Creek:** *P. H. Gentle 4693* (MICH, SMU, TEX). GUATEMALA. **Izabal:** *P. C. Standley 24896* (US), *Standley 72864* (A). **Petén:** *H. H. Bartlett 12215* (A, DS, MICH, TEX), *E. Contreras 5958* (IJ, TEX), *C. L. Lundell 16063* (LL, MEXU). MÉXICO. **Campeche:** *D. Álvarez y C. Jiménez J. 5926* (MEXU), *E. Cabrera C. 5103* (ENCB, MEXU), *M. Sousa et al. 12030* (MEXU). **Chiapas:** *G. Aguilar M. 1315* (MEXU), *D. E. Breedlove 57235* (CAS, MEXU), *F. Miranda G. 7103* (MEXU). **Quintana Roo:** *E. Cabrera C. 3250, 5163* (MEXU), *R. Duno de Stefano et al. 2090* (CICY, MEXU). **Tabasco:** *E. Matuda 3217* (A, F, MEXU, MICH), *F. Menéndez et al. 266* (MEXU), *O. Téllez y E. Martínez 907* (MEXU).

3. Lonchocarpus costaricensis (Donnell Smith) Pittier, Contr. U.S. Natl. Herb. 20: 58. 1917. Basiónimo: *Derris costaricensis* Donnell Smith, Bot. Gaz. 44: 110. 1907. TIPO: Costa Rica. Puntarenas: Península Nicoya, *A. Tonduz ex H. Pittier 13993* (lectotipo, designado por Pittier, 1917: 59, US; duplicado, GH).

Ilustración: Pittier, 1917: 58, fig. 6, pl. 26.

Esta especie es de las provincias pacíficas de Costa Rica en Guanacaste y Puntarenas. Es cercana a *Lonchocarpus eriocarinalis* Micheli de la costa occidental de México. *Lonchocarpus costaricensis* se caracteriza por el menor número de nervaduras laterales de los folíolos (9 a 13 vs. 11 a 20), flores

más grandes (13–15 mm de largo vs. 7–11 mm), y la uña del estandarte es notoriamente más larga (3–4[–6] mm vs. 1–3 mm).

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus costaricensis* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie poco colectada y de distribución restringida.

Material representativo. COSTA RICA. **Guanacaste:** *U. Chavaria 1544* (MO), *V. Ramírez y A. Soto 387* (MO). **Puntarenas:** *A. Tonduz ex Pittier 13532* (NY, P).

4. Lonchocarpus foveolatus M. Sousa, sp. nov. TIPO: México. Chiapas: Mpio. Tila, Colonia Kohijaz, 1300 m, 1 jun. 1983, *A. M. Ton 6064* (holotipo, MEXU; isotipos, MEXU, MO). Figura 2.

Haec species a congeneris mesoamericanis ad *Lonchocarpum* sect. *Obtusifolios* pertinentibus foliis 13- ad 19-foliolatis, foliolis angustis abaxialiter foveolatis, flore 8–9 mm longo atque legumine trichomatibus brunneo-cupreis sericeo distinguitur.

Árboles 12–25 m, caducifolios; corteza interior con fluido resinoso al corte; ramas jóvenes ferrugíneo a pardo-amarillento seríceas a tomentulosas, los tricomas hasta 0.3 mm, posteriormente glabrescentes. Hojas con arreglo helicoidal en el tallo; estípulas anchamente triangulares ca. 1 × 1.2 mm (en la base), erectas, pronto caducas; pecíolo 2–2.5 cm, acostillado-sulcado; hojas (13)15- a 19-folioladas; folíolos 1.5–3.5 × 0.6–1.6 cm, elípticos a ligeramente ovados, rara vez ligeramente obovados, la base ligeramente cuneada y en ocasiones ligeramente asimétrica, los márgenes algo revolutos, el ápice obtuso en ocasiones emarginado, subcoriáceos, con puntuaciones pelúcidas que corresponden a fovéolas en el envés, esparcidamente pardo-amarillento seríceo por el haz y más densamente de pardo-amarillento a ferrugíneo-seríceo en el envés; nervación camptódroma, nervaduras primaria y secundarias impresas en el envés, las nervaduras laterales 10 a 14. Inflorescencias 2–3 cm, paniculadas, erectas, pedunculadas a casi sésiles hasta 1 cm, densifloras; floración coetánea; pedúnculo floral 1.5–1.7 mm; pedicelos 1–1.2 mm; bractéolas 1–1.2 mm, lanceoladas a lineares, opuestas, distantes del 1/3 superior al ápice del pedicelo. Flores 8–9 mm; cáliz ca. 2 mm, ligeramente zigomorfo, epunteado, densamente marrón-cobrizo seríceo, dentado, el diente vexilar central prominente ca. 1.3 mm, triangular-agudo; corola lila a morada, estandarte reflexo, la lámina ca. 7 mm de ancho, oblata, cóncava, todos los pétalos adaxialmente pardo-amarillento-cobrizo seríceos; ovario 4(6)-ovulado. Legumbre 4.5–7 × 1.4–1.5 cm, indehiscente, elíptica a oblonga, aplanada, cartácea, la base atenuada a subsésil, el ápice atenuado, rostrado, obtuso, las valvas lisas, pardo ferrugíneo-cobrizo seríceas, los márgenes rectos, el vexilar y carinal nervados; semillas (inmaduras) 1 a 2 por fruto.

Distribución y hábitat. Esta especie es conocida sólo en la Meceta Central de Chiapas, como elemento de bosques caducifolios, primarios y alterados; sobre suelos rojo-arcillosos. Esta especie vive en altitudes entre 1100 a 1400 m.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus foveolatus* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie de distribución restringida, que prospera en un tipo de vegetación sujeto a una gran alteración.

Fenología. La floración se presenta de la primera quincena de mayo a principios de junio y la fructificación a mediados de agosto.

Etimología. El epíteto hace notar a las fovéolas, presentes en el envés de las hojas.

Nombre vulgar. Jit 'it 'ul (Tzeltal, *A. Méndez Ton 6064*); matabuey (*E. Martínez S. et al. 24739*).

Discusión. Esta especie es característica por sus numerosos folíolos por hoja (13 a 19), lo angosto de sus folíolos (0.6–1.6 cm), las fovéolas muy características de sus hojas; flores 8–9 mm de largo y legumbres pardo ferrugíneo-cobrizo seríceas.

Paratipos. MÉXICO. **Chiapas:** Mpio. Las Margaritas, Flor de Río, camino a Nuevo Momon, *E. Martínez S., C. H. Ramos, J. Larso, D. Benavides y C. Eufrasio 24739* (MEXU); Mpio. Tila, Ejido Tiontipac, camino a Tila–Salto de Agua, *J. I. Calzada, W. Márquez R. y S. Avendaño R. 3346* (ENCB, IBUG, INEGI, MEXU, XAL).

5. Lonchocarpus fuscopurpureus Brandegee, Univ. Calif. Publ. Bot. 10: 406. 1924. TIPO: México. Veracruz: Remudadero, abr. 1923, *C. A. Purpus 8984* (holotipo, UC; isotipos, F, GH, MO, VT).

Esta especie es endémica de Veracruz, México, dentro del área fitogeográfica de la *Flora Mesoamericana*, en selvas bajas caducifolias. Especie característica por sus escasas y separadas flores en las inflorescencias; sus hojas chicas con folíolos angostos; así como sus frutos angostos, con las valvas abombadas a la altura de las semillas.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus fuscopurpureus* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie distribuida en áreas discontinuas por presión de

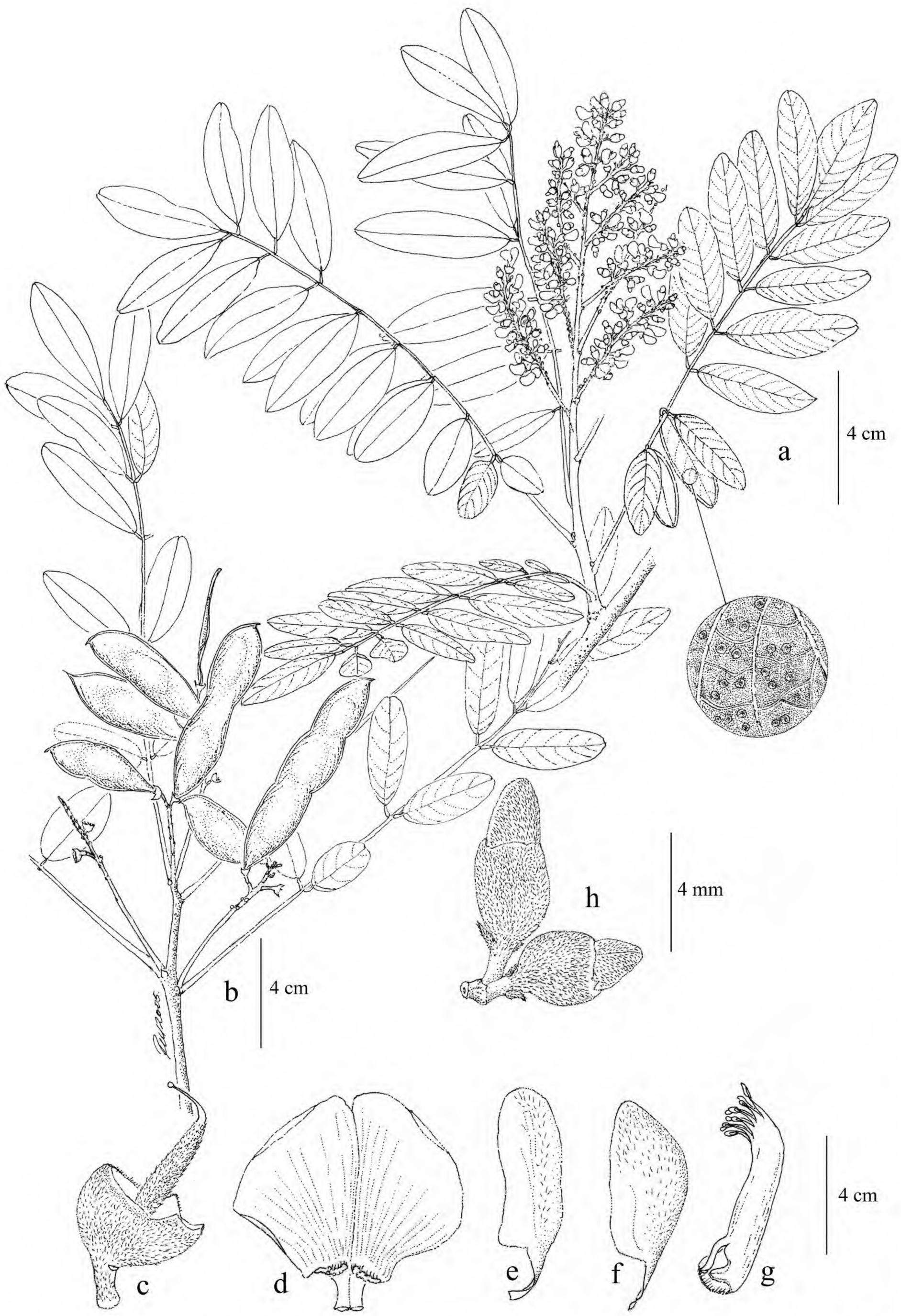

Figura 2. *Lonchocarpus foveolatus* M. Sousa. —A. Rama con hojas, inflorescencias, mostrando fovéolas en la hoja. —B. Rama con infrutescencias. —C. Cáliz. —D. Estandarte. —E. Ala. —F. Quilla. —G. Tubo estaminal. —H. Unidad biflora de la inflorescencia, mostrando las bractéolas. (A de *Menéndez 6064*; B de *Calzada 3346*; C–H de *Méndez 6064*.)

alteración a su hábitat, principalmente por la agricultura.

Material representativo. MÉXICO. **Veracruz:** *M. Sousa 3660, 3710* (MEXU), *F. Ventura A. 15194* (ENCB, MEXU).

6. Lonchocarpus lasiotropis F. J. Hermann, J. Wash. Acad. Sci. 39(9): 307. 1949. TIPO: Honduras. Atlántida: near Cangrejal River, foothills back of Ceiba, 29 July 1938, *T. J. Yuncker, J. M. Koepper y K. A. Wagner 8670* (holotipo, US; isotipos, GH, MO, NY, S).

Ilustración: Holdridge y Poveda, 1975: 352 (como *Lonchocarpus* sp.).

Árboles grandes de selvas medianas a altas, subperennifolias. Las relaciones de esta especie están con el grupo de *Lonchocarpus hedyosmus* Miquel y *L. margaritensis* Pittier de Sudamérica; en Mesoamérica es afín a *L. sylvicola* (véase discusión de ésta especie).

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus lasiotropis* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie de amplia distribución, pero habita selvas con fuerte presión de uso por la ganadería y agricultura.

Material representativo. COSTA RICA. **Cartago:** *L. R. Holdridge 6811* (CR, F, MEXU). HONDURAS. **Atlántida:** *C. Nelson 10655* (TEFH), *P. H. Allen 5459* (EAP, NY). **Santa Bárbara:** *M. Sousa et al. 13363* (EAP, MEXU). MÉXICO. **Chiapas:** *O. F. Clarke 221* (DUKE, NY, WIS), *E. W. Lathrop 5484* (F). **Veracruz:** *B. Ortiz 186* (MEXU). PANAMÁ. **Boca del Toro:** *V. C. Dunlap 347* (F, GH, US).

7. Lonchocarpus paucinervius M. Sousa, sp. nov. TIPO: Guatemala. Petén: La Cumbre, on Río Purula, 20 Sep. 1975, *C. L. Lundell y E. Contreras 19891* (holotipo, MEXU; isotipos, F, MO). Figura 3.

Haec species *Lonchocarpo piloso* M. Sousa et *L. crassispermo* Poeppendieck ut videtur affinis, sed a hoc partibus vegetativis trichomatibus usque ad 1.8 mm longis pilosis, pedunculo pedicellisque brevioribus atque calyce epunctato, ab illo foliolorum nervatione camptodroma distinguitur.

Árboles ca. 17 m; corteza interior sin fluido resinoso al corte; ramas jóvenes esparcida a muy esparcida y largamente pilosas, los tricomas hasta 1.8 mm, pronto glabras. Hojas con arreglo helicoidal en el tallo; estípulas 4–5 × ca. 1 mm (en la base), estriadas, reflexas, caducas; pecíolo 1.7–2.5 cm, canaliculado; hojas 7- a 9-folioladas; folíolos (1.5–)2.5–5.5 × 0.7–1.4 cm, elípticos a angostamente oblongos, la base obtusa, en ocasiones ligeramente asimétrica, los márgenes marcadamente revolutos, el ápice obtuso, mucronado en ocasiones emarginado, cartáceos a subcoriáceos, algo cocleados, en el haz glabros, en el envés esparcida y largamente pilosos principalmente en la nervadura primaria y los márgenes; nervación camptódroma, nervaduras primaria y secundarias impresas en el envés, las nervaduras laterales 7 a 9. Inflorescencias 2.5–5 cm, paniculadas, en ocasiones simples y axilares, densifloras, floración tardía, pedunculadas; pedúnculo floral 1.3–2.1 mm; pedicelos 1.3–2 mm; bractéolas 0.8–1.2 mm, lanceolado-oblongas a lineares, opuestas, del 1/2 al 1/4 superior del pedicelo. Flores 8–9 mm; cáliz ca. 2.2 mm, atropurpúreo, moderadamente marrón-cobrizo seríceo, epunteado, zigomorfo, el diente central carinal ca. 1.6 mm, triangular-agudo; corola rojo-púrpura, epunteada, la lámina del estandarte ca. 7 mm de ancho, orbicular, cóncava, densamente marrón-cobrizo seríceo adaxialmente, glabra abaxialmente; ovario 5-ovulado. Legumbre desconocida.

Distribución y hábitat. Esta especie es conocida sólo del tipo en Petén, Guatemala, en la cima de un cerro, en vegetación de selvas medianas a altas con sapotáceas.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus paucinervius* debe considerarse como: en peligro (EN), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie sólo conocida y recolectada en una ocasión, que habita en selvas con presión de alteración.

Fenología. La floración ocurre a finales de septiembre, sin que se tengan colecciones de material en fruto.

Etimología. El epíteto se refiere a las pocas nervaduras laterales con que cuentan sus folíolos.

Discusión. Especie aparentemente cercana a *Lonchocarpus pilosus*, con la que comparte el mismo tipo de largos tricomas pilosos, pero a la vez la nervación de los folíolos de *L. paucinervius* es camptódroma y la de *L. pilosus* es craspedódroma. También tiene relación con *L. crassispermus* Poppendieck, de la Guayana venezolana, pero la pelosidad consiste de tricomas cortos (hasta 0.5 mm de largo) de pilosos a tomentosos, también hay varias diferencias en los pedúnculos florales (2.8–3 mm de largo vs. 1.3–2.1 mm), pedicelos (2.8–3 mm de largo vs. 1.3–2 mm), y cáliz (translúcido linear-punteado vs. epunteado).

8. Lonchocarpus phlebophyllus Standley & Steyermark, Publ. Field Mus. Nat. Hist., Bot. Ser. 23: 56. 1944. TIPO: Guatemala. Chiquimula: betw. Ramírez & Cumbre de Chiquimula, on the rd. betw. Chiquimula & Zacapa, 16 Oct. 1940, *P. C. Standley 74569* (holotipo, F; isotipo, US).

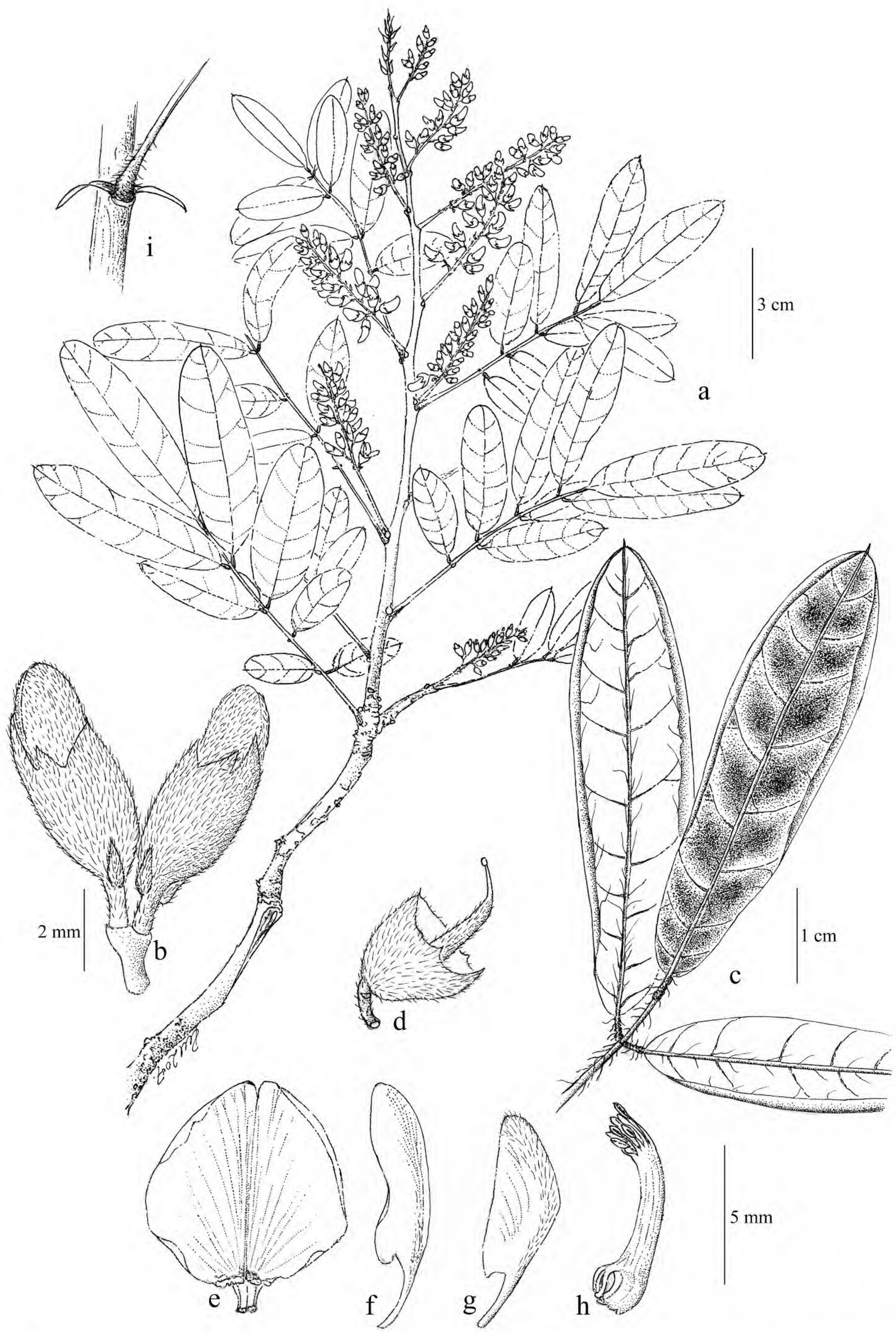

Figura 3. *Lonchocarpus paucinervius* M. Sousa. —A. Rama con inflorescencias. —B. Unidad biflora, mostrando botones florales y bractéolas. —C. Folíolos en el envés, mostrando los tricomas largamente pilosos. —D. Cáliz y gineceo. —E. Estandarte. —F. Ala. —G. Quilla. —H. Tubo estaminal —I. Estípulas. (Tomados del holotipo de *Lundell 19891*.)

Ilustración: Holdridge y Poveda, 1975: 351.

Esta especie se conoce de selvas bajas caducifolias en climas cálido-secos, se distribuye desde Guatemala a Costa Rica. Cercana a *Lonchocarpus eriocarinalis* de México, pero *L. phlebophyllus* cuenta con (3)5-folíolos por hoja (vs. 7 a 19), pétalos epunteados (vs. densamente punteado-linear translúcidos), y legumbre subcoriácea (vs. generalmente suberosa).

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus phlebophyllus* debe considerarse como: casi amenazado (NT), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie de amplia distribución, pero su hábitat esta sujeto a presión de alteración.

Material representativo. COSTA RICA. **Guanacaste:** *M. H. Grayum 12102* (MEXU, MO), *D. H. Janzen 11896* (MEXU, MO). EL SALVADOR. **Santa Ana:** *J. L. Linares 4751, 6060* (EAP, MEXU). GUATEMALA. **Chiquimula:** *M. Véliz y M. García 13446, 13474* (BIGU, MEXU). HONDURAS. **Choluteca:** *E. Martínez S. et al. 36168* (EAP, MEXU), *L. O. Williams y A. Molina R. 14118* (GH). **El Paraíso:** *A. Molina R. 14559* (US). NICARAGUA. **Boaco:** *P. P. Moreno 24334* (MEXU, MO). **Carazo:** *J. C. Sandino 4991* (MEXU, MO). **Chontales:** *W. D. Stevens 23524* (MEXU, MO). **León:** *M. Castro 113* (MEXU). **Managua:** *M. Sousa et al. 13004* (MEXU, MO). **Matagalpa:** *Sousa et al. 12956* (MEXU, MO).

9. Lonchocarpus pilosus M. Sousa, Ann. Missouri Bot. Gard. 73: 728. 1986 [1987]. TIPO: Nicaragua. Matagalpa: Santa María Ostuma, 20 July 1975, *H. B. L. Evans s.n.* (holotipo, MEXU; isotipo, FHO).

Ilustración: Sousa, 1986: 729, fig. 3.

Esta especie es endémica de Nicaragua; muy característica por la nervación craspedódroma de sus folíolos, su pelosidad es largamente pilosa, sus estípulas de gran tamaño, reflexas y semipersistentes y su legumbre de gran tamaño, densamente ferrugíneo-velutina. Aún se desconocen las flores.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus pilosus* debe considerarse como: vulnerable (VU), de acuerdo al criterio de Lista Roja (IUCN, 2001); especie de distribución restringida, con escasas colectas.

Material representativo. NICARAGUA. **Chontales:** *W. D. Stevens 23155* (MEXU, MO). **Matagalpa:** *M. Araquistain 3652* (MEXU, MO), *D. Neill 1983* (HNMN).

10. Lonchocarpus rugosus Bentham, J. Proc. Linn. Soc., Bot. 4 (Suppl.): 92. 1860. TIPO: México. Campeche: 1730, *W. Houstoun s.n.* (holotipo, BM).

Esta especie es de las más variables y de amplia distribución en el género, sus variabilidad se agrupa en unidades discretas que, hasta ahora, no presentan simpatría, y Sousa (2008) las clasifica en subespecies. Las diferencias de las subespecies se contrastan con la siguiente clave:

Clave de las Subespecies de *Lonchocarpus rugosus*

1a. Estípulas pronto caducas, tricomas de brotes vegetativos hasta 1.2 mm de largo.
  2a. Folíolos hasta 1.6 cm de ancho; legumbres hasta 1.9 cm de ancho, valvas lisas, márgenes rectos; plántulas con los cotiledones hipogeos . . . . . 10b. *L. rugosus* Bentham subsp. *gillyi* . . . . . (Lundell) M. Sousa
  2b. Folíolos hasta 4 cm de ancho; legumbres hasta 3 cm de ancho, valvas rugosas sobre las semillas, márgenes constrictos; plántulas con los cotiledones epigeos . . . . . 10a. *L. rugosus* Bentham subsp. *apricus* . . . . . (Lundell) M. Sousa
1b. Estípulas persistentes; tricomas de brotes vegetativos hasta 2 mm de largo.
  3a. Folíolos hasta 2 cm de ancho, lóbulo central carinal del cáliz ligeramente más largo que los laterales o casi tan largo como ellos; plántulas con los cotiledones epigeos. . . . . 10d. *L. rugosus* Bentham subsp. . . . . *stipulaceus* M. Sousa
  3b. Folíolos hasta 4.5 cm de ancho, lóbulo central carinal del cáliz mucho más largo que los laterales; plántulas con los cotiledones hipogeos . . . . . 10c. *L. rugosus* Bentham . . . . . subsp. *rugosus*

10a. Lonchocarpus rugosus Bentham subsp. **apricus** (Lundell) M. Sousa, Fl. Novo-Galiciana 5: 573. 1987. Basiónimo: *Lonchocarpus apricus* Lundell, Lloydia 2: 90. 1939. TIPO: México. Chiapas: Finca Esperanza, Escuintla, 3 jul. 1937, *E. Matuda S-197* (holotipo, MICH; isotipos, A, F, MO, US, VT).

Lonchocarpus stenodon Harms, Fedde, Repert. Spec. Nov. Regni Veg. 17: 324. 1921. TIPO: México. Oaxaca: Pinotepa, May 1849, *H. Galeotti 3459* (holotipo, BR; isotipos, F [fragm.], NY).

Ilustración: Witsberger et al., 1982: 155, fig. 55 (como *Lonchocarpus rugosus* Bentham).

Esta subespecie tiene la distribución más boreal de la especie, habitando áreas mas templadas, siendo frecuente en bosques de encinos y pinares, aunque también se presenta en selvas caducifolias, en altitudes de 100–1300(–1550) m. Se distingue por su legumbre ancha con las valvas rugosas a la altura de las semillas y sus plántulas con los cotiledones epigeos.

IUCN, Categoría del la Lista Roja. El estado de conservación de *Lonchocarpus rugosus* subsp. *apricus* debe considerarse como: preocupación menor (LC), de acuerdo al criterio de Lista Roja (IUCN, 2001); subespecie abundante de amplia distribución; que prospera en varios hábitats.

Material representativo. EL SALVADOR. **Ahuachapán:** *E. Sandoval 1685* (B, MEXU). **Chalatenango:** *Macqueen 506* (MEXU). **La Libertad:** *E. Martínez S. 30989* (MEXU). **La Paz:** *S. Calderón 309* (GH, US). **San Salvador:** *G. P. Lewis 1731* (K, MEXU), *A. K. Monro 3435* (B, BM). **Santa Ana:** *J. L. Linares 5121* (EAP, MEXU). GUATEMALA. **Baja Verapaz:** *W. E. Harmon 4358* (MO). **Chiquimula:** *J. A. Steyermark 30740* (F). **El Progreso:** *M. Sousa 4423*

(MEXU). **Escuintla:** *P. C. Standley 64870* (A). **Guatemala:** *Standley 59303* (A, F). **Huehuetenango:** *J. A. Steyermark 50853* (F, MO). **Jutiapa:** *Standley 75693* (F). **Retalhuleu:** *C. Hughes 428* (MEXU). **San Marcos:** *Standley 68895* (F). **Santa Ana:** *M. Véliz 13011* (MEXU). **Santa Rosa:** *J. J. Castillo 1558* (F). HONDURAS. **Choluteca:** *E. Repulski 397* (EAP, MEXU). **El Paraíso:** *A. Molina R. 166* (EAP, MEXU). **Francisco Morazán:** *M. Chorley 8* (BM, MEXU), *J. L. Linares 4066* (EAP, MEXU). **Intibucá:** *G. Rodríguez M. 76* (MEXU, MO). **La Paz:** *C. Hughes 221* (MEXU). **Lempira:** *C. Nelson 203* (MEXU, MO). MÉXICO. **Chiapas:** *D. E. Breedlove 38641* (MEXU), *E. Cabrera C. 5931* (MEXU), *A. Reyes 3955, 5322* (MEXU). **Colima:** *F. Miranda 9073* (MEXU). **Guerrero:** *H. Kruse 3720* (MEXU), *C. G. Pringle 10338* (COLO, DUKE, GH, IJ, K, MICH, SMU, TEX, US), *J. C. Soto N. 12320* (MEXU). **Jalisco:** *A. Solís M. 1796* (MEXU), *R. McVaugh 1486* (MEXU, MICH). **Edo. México:** *G. B. Hinton 5891* (A, F, MICH), *C. Zepeda Gómez 470* (MEXU). **Michoacán:** *M. Sousa et al. 10750* (MEXU), *J. C. Soto 1362* (MEXU). **Morelos:** *M. J. Curiel s.n.* (MEXU), *M. Sousa 10661* (MEXU). **Oaxaca:** *S. A. Salas M. 3006* (MEXU), *M. Sousa 5336* (MEXU), *R. Torres C. 6823* (MEXU). **Puebla:** *E. Guisar N. 1057, 1545* (MEXU), *E. Moreno M. 92* (MEXU).

10b. Lonchocarpus rugosus Bentham subsp. **gillyi** (Lundell) M. Sousa, Ceiba 49(1): 125. 2008. Basiónimo: *Lonchocarpus gillyi* Lundell, Wrightia 1: 56. 1945. TIPO: México. Chiapas: hills S of Salto de Agua, about 2 km from Salto de Agua on trail to Yajalón, 4 Oct. 1944, *C. L. Gilly y E. Henández X. 430* (holotipo, LL; isotipo, MICH).

Ilustración: Sousa, 2008: 125, fig. 1.

Hermann (1948) sinonimizó a *Lonchocarpus gillyi* Lundell dentro de *L. rugosus* Bentham, sin proponer alguna nueva categoría infraespecífica, argumentando la gran variabilidad (como el tamaño de los folíolos) de *L. rugosus*, sin embargo, *L. gillyi*, si bien aquí, la consideramos parte de *L. rugosus*, tiene características propias y distintivas como sus folíolos pequeños y lo angosto de sus legumbres (véase para otros caracteres la clave de subespecies). Esta subespecie tiene su distribución de Veracruz, México, a Colombia, sin que se le conozca en Panamá.

IUCN, Categoría de la lista Roja. El estado de conservación de *Lonchocarpus rugosus* subsp. *gillyi* debe considerarse como: preocupación menor (LC), de acuerdo al criterio de la Lista Roja (IUCN, 2001); subespecie de amplia distribución de Veracruz, México, a Colombia, sin que se le conozca en Panamá.

Material representativo. COLOMBIA. *J. C. Mutis 4305, 4700* (US). COSTA RICA. **Alajuela:** *N. Zamora 1374* (MO, NY). **Guanacaste:** *D. H. Janzen 11736, 11741* (MEXU), *L. J. Poveda 1117* (MO). **Puntarenas:** *R. W. Holm 245* (NY). **San José:** *D. Spellman 522* (MO). GUATEMALA. **Alta Verapaz:** *I. Kunkel s.n.* (USCG). HONDURAS. **Comayagua:** *C. Nelson 6280, 6866* (MEXU). **Olancho:** *E. Martínez S. 12748* (MEXU), *M. Sousa S. 13349, 13355* (EAP, MEXU). **Santa Bárbara:** *J. M. MacDougal 3123* (MEXU). **Yoro:** *J. J. Hellín 13* (MEXU), *C. Nelson 7179* (MEXU, MO). MÉXICO. **Chiapas:** *J. Calónico 24786* (MEXU), *E. Martínez S. 35759* (MEXU), *O. Téllez V. 847, 880* (MEXU). **Tabasco:** *F. Ventura A. 20599* (MEXU), *S. Zamudio 979* (MEXU). **Veracruz:** *M. Vázquez 1773* (MEXU). NICARAGUA: **Chontales:** *W. D. Stevens 21642* (MEXU, MO). **Rivas:** *W. Robleto 1062* (MEXU).

10c. Lonchocarpus rugosus Bentham subsp. **rugosus**.

La subespecie *Lonchocarpus rugosus* subsp. *rugosus* es casi endémica de la provincia fisiográfica de la Península de Yucatán, sobre suelos calizos. Se caracteriza por el largo de sus tricomas en los órganos vegetativos, estípulas persistentes; el lóbulo carinal central del cáliz mucho más largo que los laterales y sus plántulas con los cotiledones hipogeos.

IUCN, Categorías de la Lista Roja. El estado de conservación de *Lonchocarpus rugosus* subsp. *rugosus* debe considerarse como: preocupación menor (LC), de acuerdo al criterio de la lista Roja (IUCN, 2001); subespecie sólo conocida de una provincia fisiográfica, pero abundante y muy frecuente.

Material representativo. BELICE. **Belize:** *R. Liesner 1456* (MEXU, MO). **Cayo:** *E. Contreras 7046* (MO). **Corozal:** *P. H. Gentle 1082* (DS, GH, MICH, MO). **Orange Walk:** *M. Sousa 12052* (MEXU). **Stann Creek:** *P. H. Gentle 8119* (MO). **Toledo:** *G. Davidse 32221* (MEXU, MO). GUATEMALA. **Alta Verapaz:** *J. A. Steyermark 45149* (F). **Izabal:** *D. Kendig 6-5* (USCG). **Petén:** *E. Contreras 2766* (F, LL, MO). **Zacapa:** *J. A. Steyermark 42114* (F). MÉXICO. **Campeche:** *P. Álvaro M. 639* (MEXU), *C. L. Lundell 857, 1319* (A, DS, F, GH, MEXU, MICH, MO, US), *E. Martínez S. 30311, 30528* (MEXU). **Chiapas:** *D. E. Breedlove 47231* (MEXU), *A. Álvarez A. 475* (MEXU), *E. Martínez S. 10161, 11491-A, 14382, 15340* (MEXU). **Quintana Roo:** *E. Cabrera C. 9895* (MEXU), *C. E. Hughes 490* (MEXU). **Tabasco:** *C. P. Cowan 3302* (MEXU), *A. Novelo R. 38* (MEXU), *O. Téllez V. 900, 919* (MEXU). **Veracruz:** *Brigada Vázquez 1224* (MEXU). **Yucatán:** *F. Gaumer 996* (A, DS, F, MO, US), *E. C. Steward 309* (GH), *P. Yam P. 51* (XAL).

10d. Lonchocarpus rugosus Bentham subsp. **stipulaceus** M. Sousa, Ceiba 49(1): 130. 2008. TIPO: México. Oaxaca: Cerro de Oro, Distr. Tuxtepec, Mpio. San Lucas Ojitlán, 12 jun. 1973, *M. Sousa S., A. Delgado S. y A. Solis M. 7261* (holotipo, MEXU).

Ilustración: Sousa, 2008: 130, fig. 2.

La subespecie *Lonchocarpus rugosus* subsp. *stipulaceus* se confina a la región de la Planicie Costera del Golfo de México incluyendo al Distrito de Tuxtepec, Oaxaca y al Mpio. de San Andrés Tuxtla, en el sur de Veracruz, dentro del área fitogeográfica de la Flora Mesoamericana. Prospera en selvas altas subperennifolias a perennifolias. Esta subespecie es muy característica por su abundante pelosidad largo ferrugíneo

pilosa, sus enormes estípulas reflexas y persistentes y sus plántulas con los cotiledones epigeos.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus rugosus* subsp. *stipulaceus* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); las selvas en que se encuentra ésta subespecie están en riesgo de extinción.

Material representativo. MÉXICO. **Oaxaca:** *M. Sousa 7982, 8842* (MEXU), *P. Tenorio L. 19205* (MEXU), *R. Torres C. 10945* (MEXU). **Veracruz:** *I. Calzada 1631* (MEXU), *R. Cedillo Trigos 385* (MEXU, XAL).

11. Lonchocarpus sylvicola M. Sousa, sp. nov. TIPO: México. Chiapas: Mpio. Ocosingo, a 3 km al SE de Santo Domingo, camino a Lacanja, 15 abr. 1986, *E. Martínez S. 18194* (holotipo, MEXU; isotipos, MO, NY). Figura 4.

Haec species inter congeneros mesoamericanos ad *Lonchocarpum* sect. *Obtusifolios* pertinentes quoad foliolorum nervationem camptodromam apicem attenuatum vel breve acuminatum *L. lasiotropi* F. J. Hermann simillima, sed ab eo stipulis brevioribus mox caducis, nervis secundariis 9 ad 11, pedicellis bracteolis floribusque brevioribus, vexilli lamina angustiore atque ovario 3- ad 5-ovulato distinguitur.

Árboles ca. 10 m; corteza interior sin fluido resinoso al corte; ramas jóvenes moderadamente pardo-amarillento seríceas, posteriormente glabras. Hojas con arreglo helicoidal en el tallo; estípulas 0.4–0.5 mm, triangulares, patentes, pronto caducas; pecíolo 2–3 cm, acostillado-sulcado; hojas 9- a 11-folioladas; folíolos (2.5–)3–6 × 1.2–2.3 cm, lanceolados a elíptico-oblongos, la base obtusa, los márgenes ligeramente revolutos a aplanados, el ápice atenuado a corto acuminado, subcoriáceos, las áreas internervias translúcidas, el haz glabro y brillante, el envés moderadamente pardo-amarillento seríceo; nervación camptódroma, nervaduras primaria y secundarias ligeramente impresas en el envés, las nervaduras laterales 9 a 11. Inflorescencias 7–10.5 cm, axilares, simples, erectas, pedunculadas, el pedúnculo 1.5–2.5 cm, floración coetánea; pedúnculo floral 1.1–1.2 mm; pedicelos 1.7–2 mm; bractéolas 0.3–0.4 mm, lanceoladas, opuestas, del 1/3 superior al ápice del pedicelo. Flores 9–10 mm; cáliz ca. 2 mm, ligeramente zigomorfo, epunteado, densamente marrón-cobrizo seríceo, dentado, el diente vexilar central prominente 1.2–1.3 mm, triangular-agudo; corola guinda; estandarte reflexo, la lámina 7.5–8 mm de ancho, oblata, las alas en el ápice patentes respecto a la quilla, todos los pétalos adaxialmente canescente-seríceos; ovario 3- a 5-ovulado. Legumbre desconocida.

Distribución y hábitat. Esta especie es solamente conocida de una recolección en el área lacandona en Chiapas, México, como parte del elemento arbóreo de la selva alta perennifolia con *Ormosia* Jackson, en altitudes de alrededor de 450 m.

IUCN, Categorías de la Lista Roja. El estado de conservación de *Lonchocarpus sylvicola* debe considerarse como: en peligro (EN), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie sólo conocida de una recolección, en un área con fuerte presión de alteración.

Fenología. La floración ocurre alrededor de la mitad de abril; la fructificación aún no ha sido registrada.

Etimología. El epíteto se refiere a su hábitat en selvas.

Discusión. Especie que forma un grupo dentro de la sect. *Obtusifolii*, cuyos folíolos cuentan con ápices acuminados que incluye a *Lonchocarpus hedyosmus* y *L. margaritensis*, ambas de Sudamérica, y en nuestra área a *L. lasiotropis*, de esta última aquí se contrastan sus diferencias en la clave de especies de la sección.

12. Lonchocarpus velizii M. Sousa, sp. nov. TIPO: Guatemala. Petén: Mpio. Melchor de Mencos, sitio arqueológico El Naranjo, altitud 268 m, 17°08′05″N, 95°15′52″O, 28 mayo 2009, *L. Velásquez y E. Urizar 471* (holotipo, MEXU; isotipos, BIGU, MO). Figura 5.

Haec species *Lonchocarpo castilloi* Standley proxima, sed ab eo foliolis latioribus, florescentia coaetanea, floribus brevioribus atque legumine sericeo angustiore distinguitur.

Árboles 8–20 m; caducifolios; corteza escamosa, la interior sin fluido resinoso al corte; ramas jóvenes moderada y diminutamente ferrugíneo-seríceas, pronto glabras. Hojas con arreglo helicoidal en el tallo; estípulas 2.5–3.1 mm, lanceolado-aleznadas, erectas, pronto caducas; pecíolo 3–4 cm, acostillado-sulcado; hojas 7- a 9-folioladas; folíolos (2.5–)4.5–7.5 × 1.5–2.4(–2.6) cm, angosto a rara vez anchamente elípticos, en ocasiones obovados, la base cuneada, frecuentemente asimétrica, los márgenes algo revolutos, el ápice obtuso a atenuado, acuminado con los márgenes rectos, subcoriáceos, foveolados, con las áreas internervias translúcidas, algo discoloros, el haz glabro excepto pardo-amarillento seríceo sobre las nervaduras primaria y secundarias, el envés esparcidamente pardo-amarillento a ferrugíneo-estriguloso, papiloso; nervación camptódroma, nervaduras primaria y secundarias impresas en el envés, las nervaduras laterales 11 a 13. Inflorescencias 3–7 cm, paniculadas, floración coetánea, pedunculadas; pedúnculo floral 0.8–1 mm, delgado; pedicelos 1–

Figura 4. *Lonchocarpus sylvicola* M. Sousa. —A. Rama con hojas e inflorescencias. —B. Unidad biflora, mostrando botones florales y bractéolas. —C. Cáliz y gineceo. —D. Estandarte. —E. Ala. —F. Quilla. —G. Tubo estaminal. —H. Estípulas. (Tomados del holotipo e isotipos de *Martínez S. 18194*.)

1.4 mm; bractéolas 0.6–0.8 mm, lanceoladas, subopuestas, patentes, en el 1/3 superior del pedicelo. Flores ca. 6 mm; cáliz 1.8–2 mm, densamente pardo-amarillento seríceo, epunteado, zigomorfo, el diente central carinal ca. 1 mm, triangular-agudo; corola rojiza, epunteada, la lámina del estandarte 5–5.5 mm de ancho, oblata, cóncava, densamente pardo-amarillento serícea adaxialmente, glabra abaxialmente;

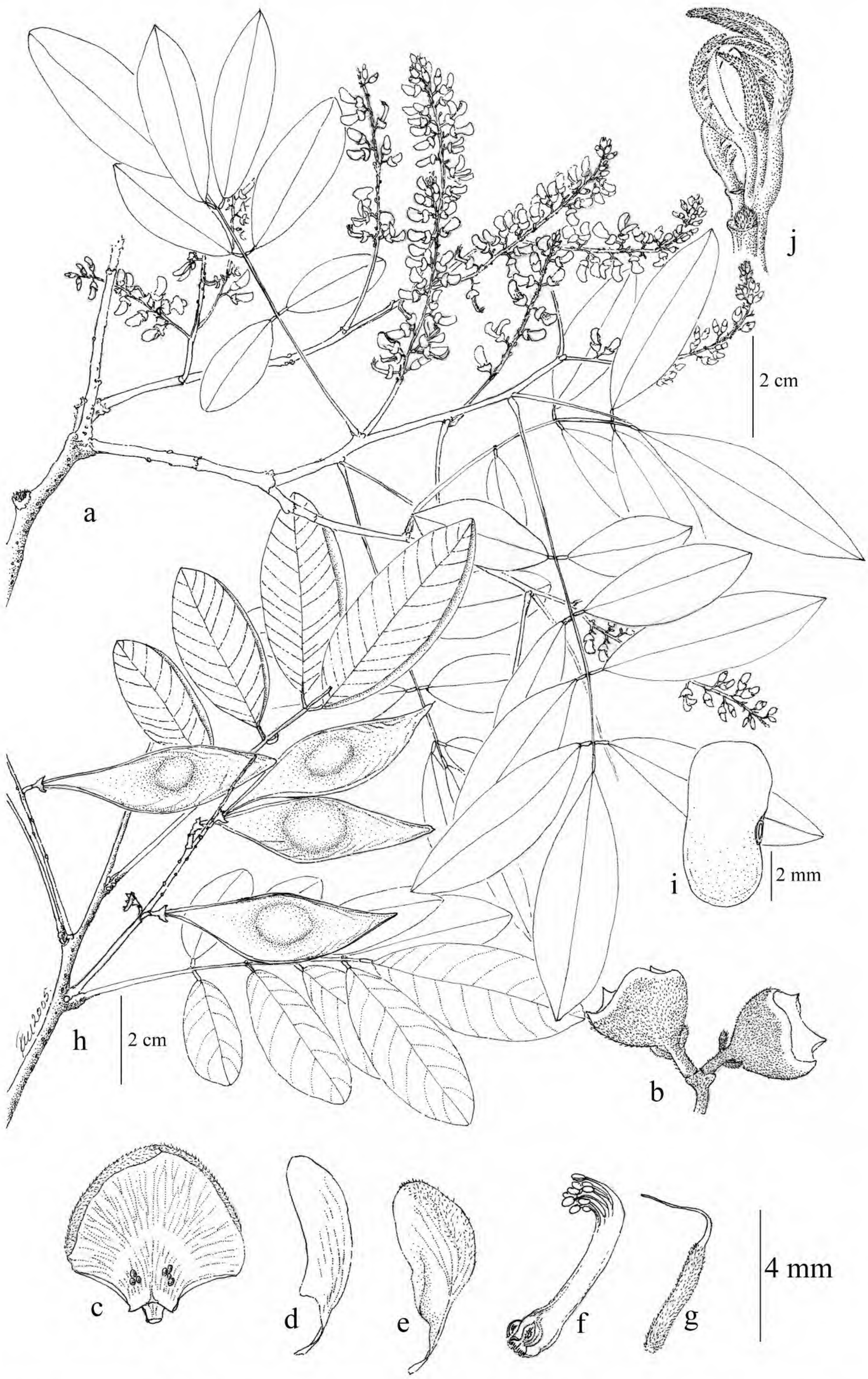

Figura 5. *Lonchocarpus velizii* M. Sousa. —A. Rama con hojas e inflorescencias. —B. Unidad biflora, mostrando cálices y bractéolas. —C. Estandarte. —D. Ala. —E. Quilla. —F. Tubo estaminal. —G. Gineceo. —H. Rama con hojas e infrutescencias. —I. Semilla. —J. Yema foliar, mostrando las estípulas. (A–G de *Lundell 16078*; H de *Véliz 12244*; I de *Véliz 7490*; J de *Lundell 16070*.)

ovario 4(5)-ovulado. Legumbre (2.7–)4–6.5 cm con una semilla, 7.5–8.3 cm con 2 ó 3 semillas, con 4 ó 5 semillas 14–16 × (1.4–)1.6–1.9 cm, elíptica a oblongo-elíptica, indehiscente, atenuada en la base, corto estipitada, obtusa y rostrada en el ápice, aplanada, ligeramente constricta sobre los márgenes entre las semillas, subcoriácea, moderada a densamente pardo-amarillento serícea, margen vexilar nervado, el carinal angostamente aquillado; semillas 1 a 2(3 a 5) por fruto, 7–8 × 3.5–4.5 × ca. 2.6 mm, castaño claro.

Distribución y hábitat. Esta especie es propia del área Sur de la Península de Yucatán, en Belice (Distr. Cayo) y Guatemala (Distr. Petén), en selvas medianas subcaducifolias a subperennifolias, riparia, en laderas, sobre suelos de origen calizo, en altitudes entre 250 a 550 m.

IUCN, Categoría de la Lista Roja. El estado de conservación de *Lonchocarpus velizii* debe considerarse como: vulnerable (VU), de acuerdo al criterio de la Lista Roja (IUCN, 2001); especie conocida en un área fisiográfica, cuya vegetación esta sujeta a fuerte presión de alteración.

Fenología. La floración se presenta a mediados de junio y la fructificación de julio a octubre.

Etimología. El epíteto se dedica a Mario Véliz Pérez (1964–) guatemalteco, nacido en Sacatepéquez, quien ha contribuido grandemente al conocimiento de la flora de su país, particularmente en el área montañosa.

Nombres vulgares. "Cabbage bark" (*G. R. Proctor 29893*) (Belice), "Jobin colorado" (*C. L. Lundell 16078*), "chaperno rojo de montaña" (*M. Véliz y J. Véliz 12491*) (Guatemala).

Discusión. Especie cercana y simpátrica a *Lonchocarpus castilloi*, de la que difiere por que en *L. velizii* sus folíolos 1.5–2.6 cm de ancho (vs. 0.6–1.5 cm), la floración coetánea (vs. tardía), flores ca. 6 mm de largo (vs. 8–9 mm), y legumbres seríceas (vs. glabras) y (1.4–)1.6–1.9 cm de ancho (vs. 2.1–3.2 cm).

Paratipos. BELICE. **Cayo:** Bengue Viejo, bordering Río Mopan, *E. Contreras 7168* (LL, MEXU); Los Altos Hill, Augustine, *G. R. Proctor 29893* (IJ, LL). GUATEMALA. **Petén:** Tikal, around Aguada Tikal, 14 June 1959, *C. L. Lundell 16078* (LL, MEXU); entrada a Yaxha, *M. Véliz 7490* (BIGU, MEXU); a 3.5–4 km del camino de terraceria del cruce hacia Yaxha, *M. Véliz y J. Véliz 12491, 12492* (BIGU, MEXU); sitio arqueológico Yaxha, *M. Véliz y J. Véliz 12495* (BIGU, MEXU).

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Eight New Species of Lauraceae from Ecuador, Peru, and Panama

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Abstract. Eight new species of Lauraceae from Andean South America and Panama are described and illustrated. Two belong to the genus *Cinnamomum* Schaeffer, *C. lanigerum* van der Werff and *C. formicarium* van der Werff & Lorea-Hernández, both from Ecuador; one species belongs to *Ocotea* Aublet, *O. pacifica* van der Werff, from Ecuador and Colombia; and five belong to *Pleurothyrium* Nees, *P. bilocellatum* van der Werff, *P. cordatum* van der Werff, and *P. obscurinerve* van der Werff from Ecuador, *P. pascoense* van der Werff from Peru, and *P. triflorum* van der Werff from Panama.

Key words: *Cinnamomum*, Colombia, Ecuador, IUCN Red List, Lauraceae, *Ocotea*, Panama, Peru, *Pleurothyrium*.

During the continuing botanical exploration of Andean South America and adjacent Panama, several Lauraceae have been collected that did not match known species. Two of those species (*Ocotea pacifica* van der Werff and *Pleurothyrium obscurinerve* van der Werff) were collected for the Florula of Samama project (Los Ríos Province, Ecuador). A floristic inventory of the Cordillera del Cóndor in Ecuador yielded two species of *Pleurothyrium* Nees (*P. bilocellatum* van der Werff and *P. cordatum* van der Werff), while fieldwork in Cordillera de Yanachaga (Peru) and in lowland rainforest on the Atlantic slope of Panama led to the discovery of two new species of *Pleurothyrium*. Finally, among recent collections from central Ecuador, two new species of *Cinnamomum* Schaeffer were found. These discoveries demonstrate that our knowledge of the flora of Andean South America and adjacent Panama is still incomplete. Further collecting efforts will almost certainly result in finding additional undescribed species of Lauraceae.

Cinnamomum

The Neotropical species of *Cinnamomum* were recently revised by Lorea-Hernández (1996), who recognized 47 species. The number of Paleotropical species of *Cinnamomum* is much higher: Rohwer (1993) gave a total number of species of about 350. *Cinnamomum* has bisexual flowers with nine 4-celled stamens (infrequently six 4-celled and three 2-celled stamens) and conspicuous staminodia with a sagittate apex. The fruits are seated in a shallow or rather deep cupule, with the tepals frequently, but not always, persisting on the margin of the cupule. Common vegetative characters among the Neotropical species are the presence of domatia in the axils of the basal secondary veins and tripliveined leaves. *Cinnamomum* differs from *Ocotea* in its well-developed staminodia; in *Ocotea* staminodia are either lacking or small, stipitiform, always without a sagittate apex. A similar clear difference between *Cinnamomum* and *Persea* Miller, another genus with nine 4-celled stamens and bisexual flowers, is lacking, partly because *Persea* is so variable. Most species of Neotropical *Persea* have unequal tepals, with the outer three smaller than the inner three, whereas in *Cinnamomum* tepals are equal. Domatia and tripliveined leaves do not occur in *Persea*. However, a number of species with equal tepals, bisexual flowers, large staminodia, and pinnately veined leaves without domatia are difficult to place. Traditionally, the species in this group with persistent tepals are placed in *Persea*, while those with caducous tepals are placed in *Cinnamomum*. I accept these concepts and also acknowledge that more studies are needed to establish monophyletic genera or species groups.

1. **Cinnamomum formicarium** van der Werff & Lorea-Hernández, sp. nov. TYPE. Ecuador. Bolívar: along rd. Chillanes–El Tambo, 1700–2300 m, 19 July 1991, *H. van der Werff, B. Gray & G. Tipas 12498* (holotype, MO; isotype, MO). Figure 1.

Species nova quae a congeneris ramulis fistulosis valde angulatis et foliis magnis recedit.

Trees, to 20 m; twigs sharply angular, thick, to 1.5 cm diam., hollow, occupied by slow-moving, nonaggressive ants, stems covered with appressed hairs when young, the hairs matted and remaining as patches on older parts, eventually becoming sparse; terminal buds densely appressed pubescent. Leaves alternate, elliptic to broadly elliptic, 28–40(–60) × 14–28 cm, base acute to obtuse, apex obtuse to acute (often damaged due to the large size of the blade),

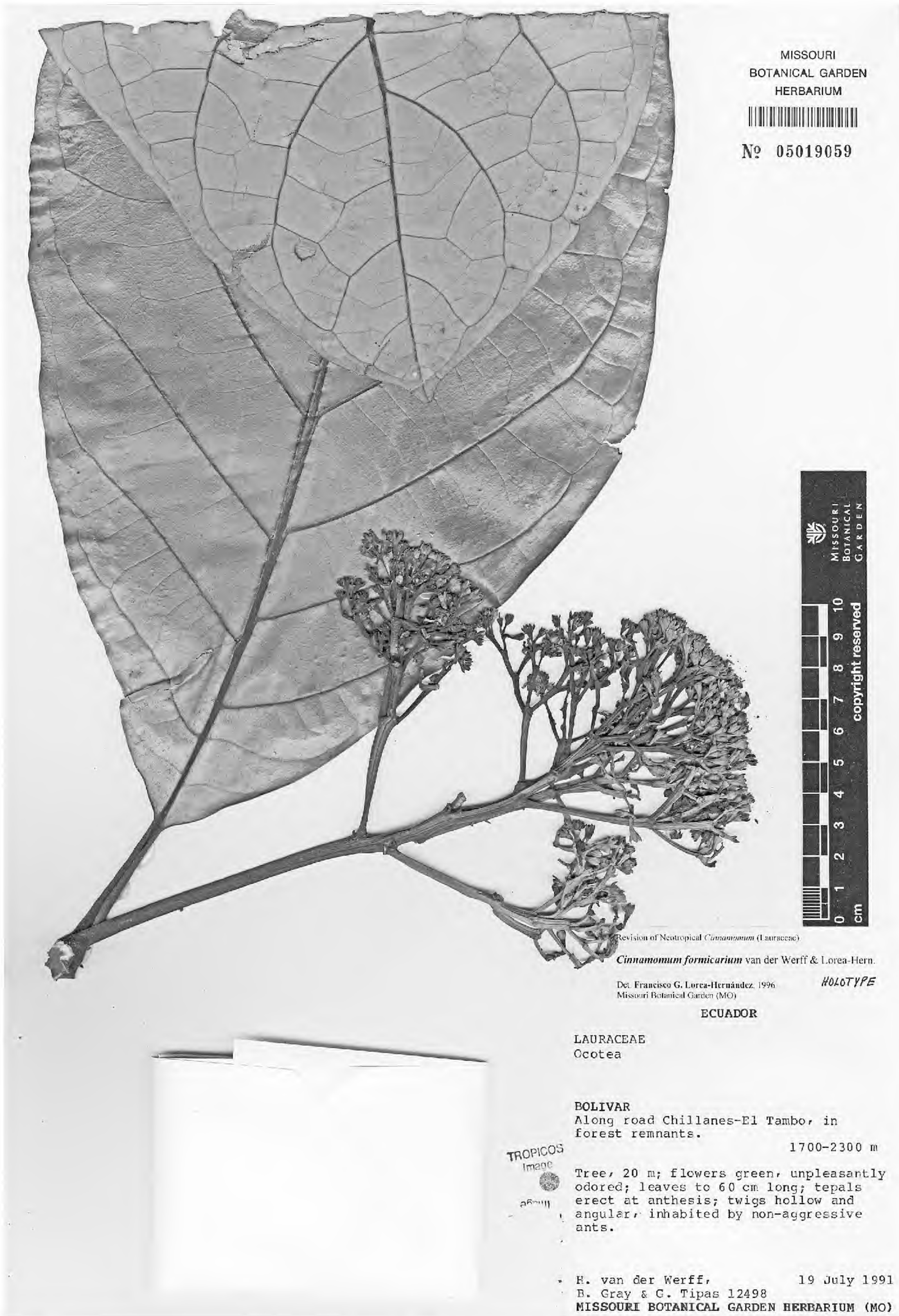

Figure 1. Holotype of *Cinnamomum formicarium* van der Werff & Lorea-Hernández.

abaxially minutely tomentulose, glabrescent with age, adaxially glabrous, pinnately veined, secondary veins in 7 to 12 pairs, midrib and secondary veins slightly impressed adaxially, raised abaxially, domatia lacking; petioles 3–7 cm, canaliculate, with the same indument as the twigs. Inflorescences 15–25 cm, paniculate-cymose, in the axils of leaves, glabrous or nearly so; pedicels 2.5–3.5 mm, glabrous. Flowers green, ca. 3 mm diam.; tepals 6, equal, elliptic, ca. 2.5 mm, glabrous on the outer surface, pubescent on

the inner surface, with an abscission line near the base; stamens 9, 2.3–3 mm, filaments pubescent, anthers glabrous, outer 6 stamens 4-celled, inner 3 stamens 2-celled and with 2 globose glands near the base; staminodia present, 1.5–2 mm, filament pubescent, the tip triangular-sagittate; pistil 2–3 mm, glabrous, style about as long as the ovary, receptacle cup-shaped, glabrous inside. Immature fruit ca. 10 × 7.5 mm, ellipsoid, cupule cup-shaped, ca. 11 × 7 mm, tepals not persisting in fruit.

Discussion. The new species is very distinct due to its large leaves (to 40–60 cm long), the fistulose and sharply angled twigs, and the densely flowered, glabrous inflorescences. The hollow center in the fistulose twigs can range from 5–7 mm in diameter. Other characters of the new species infrequently found in Neotropical *Cinnamomum* species are the absence of domatia, tepals not persistent in fruit, the inner three stamens 2-celled, and pinnately veined leaves. The flowers have an unpleasant odor, reminiscent of urine.

IUCN Red List category. *Cinnamomum formicarium* is known from very few collections and is therefore listed as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Paratypes. COLOMBIA. **Cauca:** Cordillera Occidental, La Gallera, Micay Valley, 1500–1800 m, *E. Killip 7904* (NY). **Valle:** Hoya del Río Cali, Río Pichindé, entre Los Cárpatos y El Olivo, 2025–2920 m, *J. Cuatrecasas 21726* (F); monte La Guarida, filo de la cordillera sobre La Carbonera, entre Las Brisas y Albán, 1950–2000 m, *J. Cuatrecasas 22176* (F). ECUADOR. **Bolívar:** along rd. Chillanes–Bucay, *V. Zak & J. Jaramillo 2564* (MO); along rd. Chillanes–El Tambo, 1700–2300 m, *H. van der Werff, B. Gray & G. Tipas 12478* (MO).

2. Cinnamomum lanigerum van der Werff, sp. nov. TYPE: Ecuador. Carchi: Espejo, Faldas del Cerro Golondrinas Hembra, 00°51′N, 78°07′W, 2300–2400 m, 20 Aug. 1994, *W. Palacios 12721* (holotype, QCNE; isotypes, AAU, HBG, MO, NY, US). Figure 2.

Species nova *Cinnamomo floccoso* van der Werff similis, sed ab eo floribus pubescentibus, indumento foliorum lanoso et petiolis longioribus (usque ad 1.5 cm, nec 0.5 cm) recedit.

Small tree, to 8 m; twigs angular, solid, densely pubescent, the indument covering the surface completely, light brown, the hairs short, curled, stems glabrescent with age; terminal buds densely pubescent as the young twigs. Leaves alternate, broadly ovate-elliptic to elliptic, 8–15 × 5–11 cm, stiffly chartaceous, base obtuse to rounded, apex obtuse or acute, margin flat, young leaves adaxially moderately densely pubescent with short, curled hairs, soon becoming glabrous and lustrous, abaxially densely woolly pubescent, the curled hairs completely covering the surface, the hairs becoming light brown on older leaves but not wearing off, domatia lacking; secondary veins in 4 to 6 pairs, impressed adaxially and raised abaxially, the older leaves somewhat bullate, the basal 2 pairs of secondary veins crowded near the base of the leaf; petioles 10–14 mm, canaliculate or flat above. Inflorescences 5–15 cm, in the axils of leaves, paniculate-cymose, rather densely tomentose, the surface largely covered. Flowers green, 4–5 mm diam.; pedicels ca. 1 mm, tomentose, much shorter than the flowers; tepals 6, equal or the outer 3 slightly shorter, 2.5–3 × ca. 1 mm, pubescent on both surfaces, half-erect at anthesis and spreading in older flowers, with an abscission line near the base and breaking off in old flowers; stamens 9, outer 6 4-celled, inner 3 2-celled, 2.5–3 mm, filaments pubescent, ca. 1.5 mm, anthers glabrous, inner 3 stamens with 2 round glands near the base; staminodia present, ca. 1.5 mm, filament pubescent, the glabrous apex triangular-sagittate, wider than the filament; pistil glabrous, ca. 3 mm, ovary round, ca. 1 mm, style slender, ca. 2 mm; receptacle cup-shaped, with a few appressed hairs inside. Fruits not known.

Discussion. *Cinnamomum lanigerum* is closely related to *C. floccosum* van der Werff from northern Peru. The two species share the impressed venation, a dense indument, leaves with an obtuse or rounded base, and presence at relatively high altitudes. They differ as follows: *C. lanigerum* has pubescent flowers, short pedicels (much shorter than the flowers), petioles at least 10 mm long, and a woolly indument on the abaxial leaf surface, while *C. floccosum* has glabrous flowers, pedicels as long as the flowers or slightly longer, petioles ca. 5 mm long, and a shaggy indument on the abaxial leaf surface (hairs mostly straight, 0.5–0.7 mm long). Less closely related is *C. palaciosii* van der Werff, also from rather high altitudes (ca. 3000 m) in Ecuador; it has large (to 25 cm), tripliveined leaves, impressed midrib and secondary veins, an indument of more or less straight hairs, and glabrous flowers.

Although most species of *Cinnamomum* have all stamens 4-celled, the presence of two locules on the inner three stamens is not rare. Lorea-Hernández (1996) recognized 47 species in his revision of Neotropical *Cinnamomum* and, of those, 12 had inner stamens with two locules. In *C. floccosum* the inner stamens have two or four locules with the upper pair greatly reduced.

IUCN Red List category. This species is known only from the type collection and is listed as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Figure 2. Holotype of *Cinnamomum lanigerum* van der Werff.

Ocotea

Ocotea is the largest genus of Lauraceae in the Neotropics, with an estimated 300 species (Rohwer, 1993). It is an assemblage of species characterized by having paniculate-cymose inflorescences and flowers with nine 4-celled stamens with the locelli arranged in two superposed pairs. *Ocotea* has been and still is the holding place for many species that do not fit in any of the other, better-defined genera ("*Ocotea* is the dustbin

of the Perseeae," Rohwer, 1993: 382). Rohwer (1986) published an overview of *Ocotea* based on an extensive study of type specimens and included keys to species or species groups. This publication has greatly increased our understanding of *Ocotea*. Since then, an estimated 60 additional species of *Ocotea* have been published by various authors. A synopsis of the 102 Central American species, including a key, was published by van der Werff (2002). A phylogenetic analysis of the genera of Lauraceae (Chanderbali et al., 2001) strongly suggested that *Ocotea* in its current concept is polyphyletic and consists of at least five species groups. The new species described below is one of many new ones from northern South America; its description is needed for the preparation of the Lauraceae treatment for the florula of Cerro Samama in Ecuador.

3. Ocotea pacifica van der Werff, sp. nov. TYPE: Ecuador. Pichincha: along rd. Nanegal–Palmitopamba, 1200 m, 10 July 1991, *H. van der Werff, B. Gray & G. Tipas 12269* (holotype, QCNE; isotype, MO). Figure 3.

Species nova *Ocoteae stenoneurae* Mez & Pittier similis, sed ab ea tepalis intus sparse pubescentibus, basi foliorum plana, staminodiis dense pubescentibus et fructu ellipsoideo recedit.

Tall trees, to 45 m; twigs densely brown tomentulose, the surface completely covered when young, indument sparser with age, solid; terminal buds densely brown tomentulose. Leaves alternate, elliptic to obovate, 9–21 × 3–8 cm, chartaceous, gradually narrowed toward the base, but not decurrent on the petiole, flat or faintly inrolled near the base, the tip shortly acuminate, adaxially glabrous except for some pubescence on the midrib, abaxially sparsely to moderately pubescent, the hairs appressed or ascending, axillary tufts of hairs lacking, venation immersed adaxially, raised abaxially, tertiary venation scalariform, lateral veins 9 to 12 on each side; petioles 5–10 mm, flat on the upper surface. Inflorescences 9–23 cm, cymose-paniculate, in the axils of distal leaves, densely tomentulose, the surface not visible. Flowers funnel-shaped, the base gradually narrowed in the petioles; pedicels ca. 2 mm; tepals ca. 1.5 mm, half-erect, densely pubescent on the outer surface, sparsely pubescent on the inner surface, the surface largely visible; stamens 9, all 4-celled, 0.8–1 mm, outer 6 with the cells opening introrse, inner 3 with cells opening extrorse, filaments pubescent, ca. 1/3 as long as the anther, anthers glabrous; staminodia representing whorl IV present, stipitiform, ca. 0.5 mm, pubescent; pistil ca. 2 mm, glabrous, style ca. 0.5 mm; receptacle deep, pubescent inside. Fruit ca. 3.5 × 1.8 cm, ellipsoid, cupule near maturity shallowly cup-shaped, ca. 15 × 8 mm, less mature cupules relatively deeply cup-shaped.

Discussion. *Ocotea pacifica* is so named because of its distribution in lowland or premontane forest from 50–1200 m on the Pacific side of the Andes. The taxon has been confused with *O. stenoneura* Mez & Pittier, and duplicates of most collections, including the type collection, have been distributed under that name. The two species differ as follows: *O. pacifica* has the inner surface of the petals sparsely pubescent, with most of the surface visible, the base of the leaves are flat or nearly so and scarcely decurrent on the petiole, the staminodia are densely pubescent, the fruit is ellipsoid and the cupule is cup-shaped, while *O. stenoneura* has the inner surface of the tepals densely pubescent, with the surface not visible, the base of the leaves are strongly decurrent and inrolled, the staminodia are sparsely pubescent, the fruit is round or nearly so and the cupule is a flat plate. *Ocotea stenoneura* has also a glaucous abaxial leaf surface. Although the staminodial character is difficult to see, differences in leaf base, fruit shape, and cupule shape allow identification without problems. The new species is known from Colombia and Ecuador, while *O. stenoneura* is only known from Costa Rica and Panama.

IUCN Red List category. *Ocotea pacifica* is known from several collections in Ecuador and Colombia and occurs in several protected areas. Given this distribution, it is listed as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

Paratypes. COLOMBIA. **Antioquia:** Yali, Hac. Martabana, *J. Fernández & P. Jiménez 45* (MO); El Humbo, 130 mi. N of Bogota, *A. Lawrence 728* (MO). ECUADOR. s. prov.: Santo Domingo, *Benoist 3041* (P). **Esmeraldas:** Fila de Bilsa, E of San José de Bilsa, *A. Gentry & C. Josse 72764* (MO); Río Pambil, Estero Pena Lisa, *C. Jativa & C. Epling 1068* (MO); Río Hoja Blanca, *E. Little & R. Dixon 21067* (MO); Quininde, Bilsa Biol. Station, Mache Mtns., *J. Clark & C. Watt 925* (MO); Quininde, Bilsa Biol. Station, Reserva Ecol, Mache-Chindul, *J. Clark, C. Pallis & J. West 4604* (MO). **Carchi/Esmeraldas:** near Lita, *H. van der Werff, C. Dodson & W. Palacios 9562* (MO). **Los Ríos:** Hac. Clementina, Cerro Samama, *B. Ståhl, S. Petterson & T. Tranefors 5732, 5739, 5775* (MO, S), *B. Ståhl & X. Cornejo 5959* (S), *6048* (MO, S), *B. Ståhl & S. Pettersson 6363* (MO, S). **Pichincha:** Reserva Guaycuyacu, *J. Clark, C. Clark, S. Nazarro & J. West 4984* (MO); along rd. Nanegal–Palmitopamba, *H. van der Werff, B. Gray & G. Tipas 12284* (MO); Parroquia Puerto Quito, Reserva Forestal Endesa, 10 km N de Alvaro Perez Intriago, *C. Ceron & J. Ayala 10077* (MO, QCNE).

Pleurothyrium

Pleurothyrium is a medium-sized, Neotropical genus of 48 species characterized by the strongly

Figure 3. Isotype of *Ocotea pacifica* van der Werff.

enlarged glands at the base of the inner stamens. The glands conspicuously protrude between the outer stamens in some species, while in others they become united, forming a pillowlike mass surrounding the stamens. All previously described species in *Pleurothyrium* have nine 4-celled stamens and fruits that are seated in a well-developed cupule. The inflorescences originate generally, but not always, in the axils of bracts and are infrequently found in the axils of normal leaves. The genus was revised by van der

Werff (1993), who recognized 40 species. Since then, three additional species have been described. In this contribution five species are added, one of which is the first in the genus with 2-celled stamens. Three novelties are known from Ecuador only, one from the Pacific side of the Andes and the other two from the Cordillera del Cóndor, the fourth species is only known from Panama, and the fifth was recently collected in central Peru.

4. **Pleurothyrium bilocellatum** van der Werff, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: along rd. Guayzimi–Pachicutza, in forest on white sand shortly before reaching Pachicutza, 04°08′27″S, 78°38′25″W, 900 m, 2 Nov. 2006, *H. van der Werff, B. Gray & W. Quizhpe 21882* (holotype, QCNE; isotypes, AAU, B, BRIT, COL, F, G, GB, GH, HBG, HUT, K, L, LE, LOJA, MO, NY, P, PE, QCA, US, XAL). Figure 4.

Species nova quae a congeneris staminibus bilocellatis recedit.

Tree, to 12 m; twigs angular, solid, sparsely or very sparsely pubescent with short, spreading, white hairs, terminal buds densely pubescent, the hairs spreading. Leaves alternate, elliptic, 10–18 × 4–7 cm, very sparsely pubescent when young, soon becoming glabrous, but some short, erect hairs persisting along the major veins, base flat, acute, apex acute, lateral veins 6 to 9 on each side, reticulation weakly raised adaxially, more so abaxially, domatia lacking; petioles 1–1.7 cm, terete, glabrous or with some appressed hairs. Inflorescences 5–8 cm, red, in axils of bracts or in axils of leaves, paniculate-cymose. Flowers cream, 3.5–4.5 mm diam.; pedicels 4–5 mm; tepals 6, equal, ca. 2 × 1 mm, with some appressed hairs outside and some small papillae on the inner surface, appearing almost glabrous, spreading in young flowers, becoming reflexed in older flowers; stamens 9, all 2-celled, outer 6 with a very short filament attached at the base of the tepals, anther flat, bent upward and pressed against the enlarged glands, the locelli introrse-apical, inner 3 stamens ± columnar with the apex enlarged and bent outward, the locelli extrorse-apical; glands enlarged and separating stamens from each other, but not forming a pillowlike mass and enclosing the stamens; staminodia not seen; pistil 1–1.5 mm, style very short, stigma conspicuous. Cupule shallowly cup-shaped, with a broad hat-shaped rim with a scalloped edge, ca. 2.5 cm diam. when dry; fruit ellipsoid, ca. 2 × 1.5 cm.

Discussion. Traditionally, the number of locelli (two vs. four) has been used as a character defining genera. Some genera, however, can be readily recognized by vegetative characters or characters of the tepals, and in these genera the number of locelli and number of stamens is often found to be variable (van der Werff & Richter, 1996). Examples of such genera in the Neotropics are *Caryodaphnopsis* Airy Shaw (with opposite, often tripliveined leaves and strongly unequal tepals) and *Persea* (group with unequal tepals), both of which have the majority of their species with 4-locular stamens and a few with 2-locular stamens. In other cases, generic pairings differing only in number of locelli are still recognized, such as *Mezilaurus* Kuntze ex Taubert and *Williamodendron* Kubitzki & H. G. Richter, *Ocotea/Rhodostemonodaphne* Rohwer & Kubitzki and *Endlicheria* Nees, as well as *Litsea* Lamarck and *Lindera* Thunberg. The new species described above could thus be placed in a new genus or included in *Pleurothyrium* as the only 2-locular species among the other 4-locular species. I prefer the latter position; the enlarged glands and the position of the inflorescences partly in the axils of bracts indicate a placement in *Pleurothyrium*.

IUCN Red List category. This species is known from two collections, made from the same tree, and is listed as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Paratype. ECUADOR. **Zamora-Chinchipe:** along rd. Guayzimi–Pachicutza, in forest on white sand, *H. van der Werff, B. Gray & J. C. Ronquillo 19575* [same tree as type collection] (AAU, K, LOJA, MO, NY).

5. **Pleurothyrium cordatum** van der Werff, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: in vic. of mining camp at Río Tundaime, 03°34′44″S, 78°24′11″W, 1000–1200 m, 12 Nov. 2004, *H. van der Werff, B. Gray, J. C. Ronquillo & W. Quizhpe 19537* (holotype, QCNE; isotypes, AAU, CANB, HBG, K, L, LOJA, MO, NY, P, US, USM). Figure 5.

Species nova quae a congeneris foliis ellipticis rigide chartaceis basi cordatis recedit.

Trees, to 15 m; twigs terete, solid, densely brown tomentulose, the surface fully covered; terminal buds densely brown tomentulose. Leaves alternate, evenly distributed along the twigs, elliptic to elliptic-oblong, 12–21 × 4.5–8 cm, stiffly chartaceous, base cordate to rounded, lamina flat, apex acute to acuminate, adaxially glabrous, venation slightly impressed, abaxially appearing glabrous but covered with fine, tightly appressed, light-colored hairs, the midrib and major veins with brown, spreading hairs, midrib and lateral veins raised, dark reticulation contrasting with the light lamina, lateral veins 8 to 14 pairs, weakly loop-connected in the distal half of the leaf; petioles 1.5–3 cm, brown tomentulose as the twigs, canalicu-

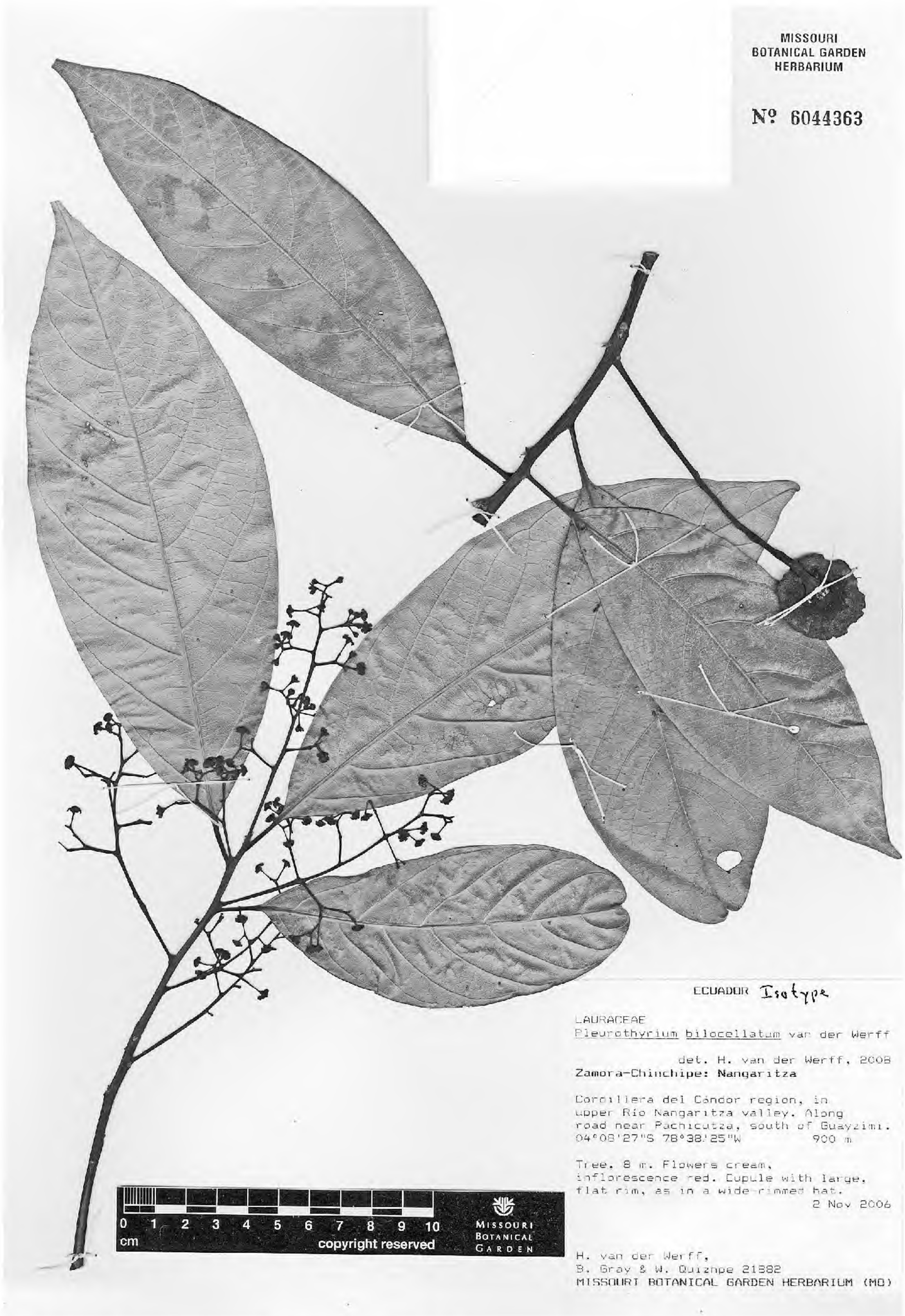

Figure 4. Isotype of *Pleurothyrium bilocellatum* van der Werff.

late. Inflorescences 5–12 cm, paniculate-cymose, densely brown tomentulose, in the axils of bracts. Flowers 6–7 mm diam., white; pedicels ca. 4 mm; tepals 2–3 mm, ovate-elliptic, spreading at anthesis, outer 3 tepals tomentulose on the outside, inner 3 tepals with a triangular, basal, tomentulose patch, otherwise papillose, inner surface of the tepals papillose; stamens 9, all 4-locular, outer 6 with a short (ca. 0.3 mm) filament, the anther twice as long, bent toward the center of the flower, the locelli in 2

Figure 5. Isotype of *Pleurothyrium cordatum* van der Werff.

pairs, lateral, at maturity the anthers raised above the glands; inner 3 stamens barely raised above the glands, the anther bent outward, the locelli lateral; glands at base of the inner stamens enlarged, growing outward between the outer stamens, but not surrounding those and not fused in a pillowlike mass; staminodia not seen; pistil ca. 1 mm, densely pubescent, ovary gradually narrowed into the style, receptacle deeply cup-shaped, pubescent inside. Fruits and cupules not known.

Discussion. *Pleurothyrium cordatum* can be easily recognized by its elliptic, stiffly chartaceous leaves with a cordate base. A few other species of *Pleurothyrium* also have leaves with a cordate base, but these species (*P. insigne* van der Werff, *P. maximum* O. C. Schmidt) have large (20–60 cm long), obovate leaves, gradually narrowed toward the base and at the base abruptly cordate or rounded. *Pleurothyrium panurense* (Meisner) Mez and *P. bifidum* Nees have a similar finely appressed indument on the abaxial leaf surface, but those species differ in having the outer stamens completely enclosed by the enlarged glands. The pubescent pistils and the rather small flowers with the outer stamens separated by the enlarged glands, but not surrounded by them, are also useful characters.

IUCN Red List category. *Pleurothyrium cordatum* is known only from the type collection and is listed as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

6. **Pleurothyrium obscurinerve** van der Werff, sp. nov. TYPE: Ecuador. Los Ríos: Hac. Clementina, Cerro Samama, 79°19′W, 01°39′S, 400 m, 11 Dec. 1996, *J. T. Knudsen, B. Ståhl, Å. Johannessen & S. Roponen 706* (holotype, S; isotype, MO). Figure 6.

Species nova *Pleurothyrio immerso* van der Werff similis, sed ab eo ovario pubescenti, floribus majoribus (7–9 mm, non 5 mm diam.) et glandulis basi staminum internorum liberis (non confluentibus) recedit.

Small tree, to 15 m; twigs terete, solid, moderately but inconspicuously appressed pubescent; terminal buds densely appressed pubescent. Leaves alternate, elliptic, 5.5–13 × 2–5.5 cm, papyraceous, base acute to obtuse, apex acuminate, acumen to 1 cm, flat, adaxially glabrous and gland-dotted, abaxially glabrous or with a few appressed hairs, axillary tufts of hairs lacking, venation immersed on both surfaces, lateral veins ca. 7, but scarcely visible; petioles 7–10 mm, narrowly canaliculate on the upper surface. Inflorescences 3–5.5 cm, in the axils of bracts or leaves, with 2 to 6 flowers, sparsely appressed pubescent, the indument denser distally. Flowers 7–9 mm diam., white or yellowish; pedicels ca. 5 mm; petals 6, spreading to somewhat reflexed at maturity, papillose on both surfaces, elliptic, ca. 3 mm; stamens 9, all 4-celled, outer 6 with the anther bent inward and the locelli lateral; glands at the base of the inner stamens strongly enlarged and grown outward, surrounding the stamens, but not fused; pistil glabrous, ca. 2 mm, style half as long as the ovary; receptacle cup-shaped, appressed pubescent inside. Immature fruit ellipsoid, ca. 1.7 × 1.3 cm, cupule trumpet-shaped, with a double margin, the outer margin somewhat spreading and exceeding the inner margin.

Discussion. Distinctive vegetative characters for *Pleurothyrium obscurinerve* are the thin leaves with very inconspicuous venation and gland dots on the adaxial surface. With the exception of *P. immersum* van der Werff, all other species of *Pleurothyrium* have chartaceous or firmly chartaceous leaves with readily visible venation. However, *P. immersum*, endemic to Costa Rica, differs from *P. obscurinerve* in its smaller flowers (ca. 5 mm vs. 7–9 mm diam.), pubescent ovaries, pubescent inner surface of the tepals (vs. papillose inner surface of the tepals), and the glands and stamens that form a domelike structure in the center of the flower with the glands strongly enlarged and fused (vs. glands that are enlarged but free and stamens raised above the glands, not forming a domelike structure). Cupules and fruits are not yet known for *P. immersum*. Another close relative is *P. glabritepalum* van der Werff, known from Chocó, Colombia, and Esmeraldas, Ecuador; this species has relatively thin leaves, gland-dotted on the adaxial surface, with the same shape as *P. obscurinerve* and short (2–4 cm), few-flowered (1 to 3 flowers) inflorescences. There are, however, clear differences between the two species: *P. glabritepalum* has brown tomentose or tomentulose twigs, flowers ca. 13 mm in diameter, a sparse, erect indument on the abaxial leaf surface, and clearly visible venation on the abaxial leaf surface.

Pleurothyrium obscurinerve grows at altitudes of 400–600 m. Specimens without flowers would almost certainly not be recognized as *Pleurothyrium*; fruiting specimens would very likely be placed in *Licaria* due to the double-margined cupule.

IUCN Red List category. *Pleurothyrium obscurinerve* is known from a few collections along the lower western slope of the Andes in Ecuador and is listed as Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001).

Paratypes. ECUADOR. **Esmeraldas:** Bilsa Biol. Station, *J. Clark & P. Nutt 4111* (MO, QCNE, US), *J. Clark, K. Berg & J. Leffingwell 2397* (MO). **Los Ríos:** Hac. Clementina, Cerro Samama, *B. Ståhl & S. Pettersson 6354* (MO, S), *B. Ståhl, M. Ehn & S. Pettersson 6598* (MO, S).

7. **Pleurothyrium pascoense** van der Werff, sp. nov. TYPE: Peru. Pasco: Oxapampa, Distr. Huancabamba, Zona de amortiguamiente del Parque Nac. Yanachaga–Chemillén, Sector Tunqui–Agua Salada, 10°16′47″S, 75°32′31″W, 1480 m, 26 Sep. 2007, *A. Monteagudo, A. Peña,*

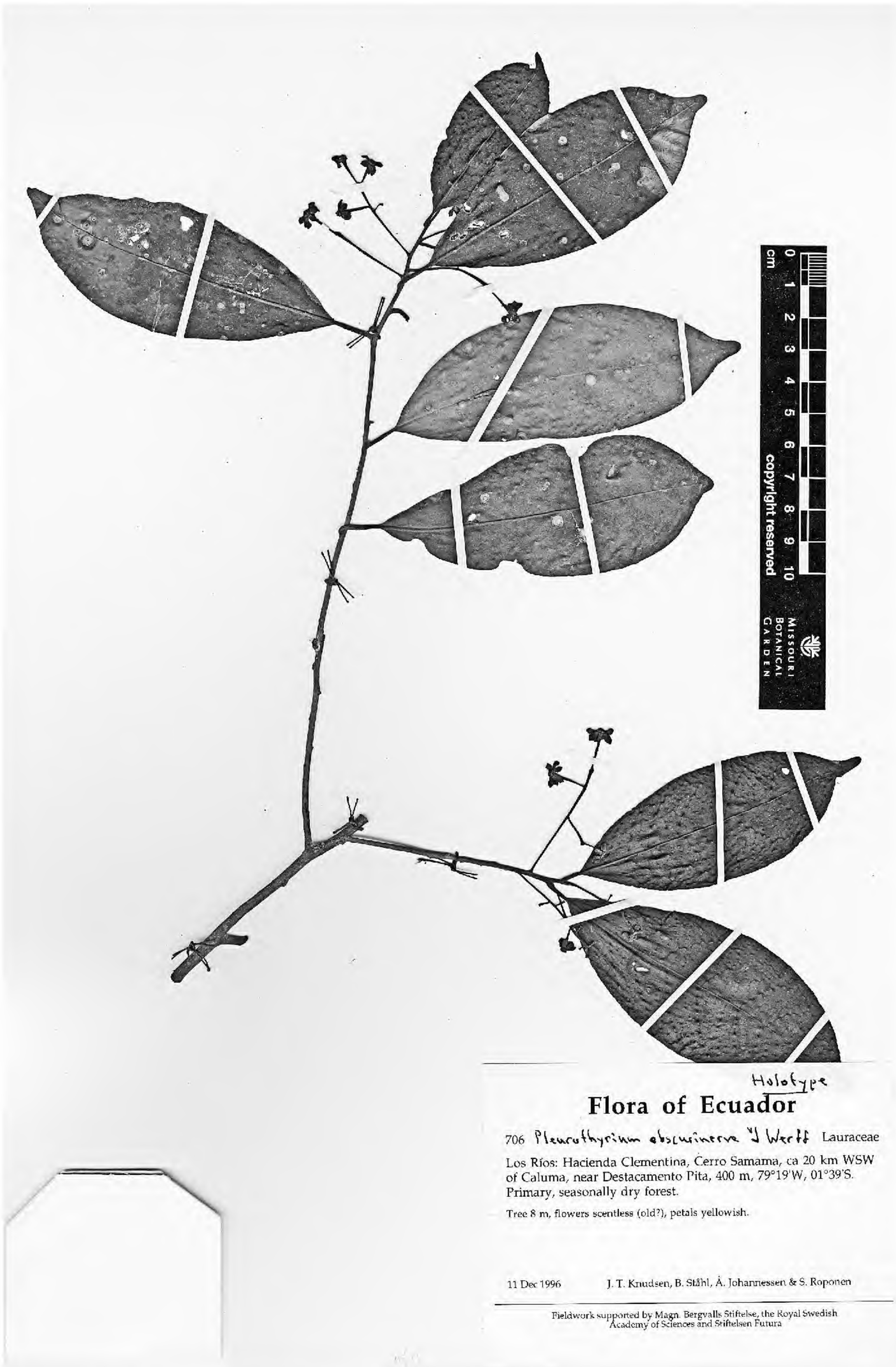

Figure 6. Holotype of *Pleurothyrium obscurinerve* van der Werff.

J. Mateo, V. Flores & C. Rojas 15339 (holotype, MO). Figure 7.

Species nova *Pleurothyrio trianae* (Mez) Rohwer affinis, sed ab eo ramulis inflorescentiisque dense pubescentibus trichomatibus erectis, nervis secundariis et tertiariis in pagina inferiore elevatis et venatione brochidodroma recedit.

Tree, to 18 m; twigs solid, angular, densely brown pubescent, the hairs erect, covering the surface

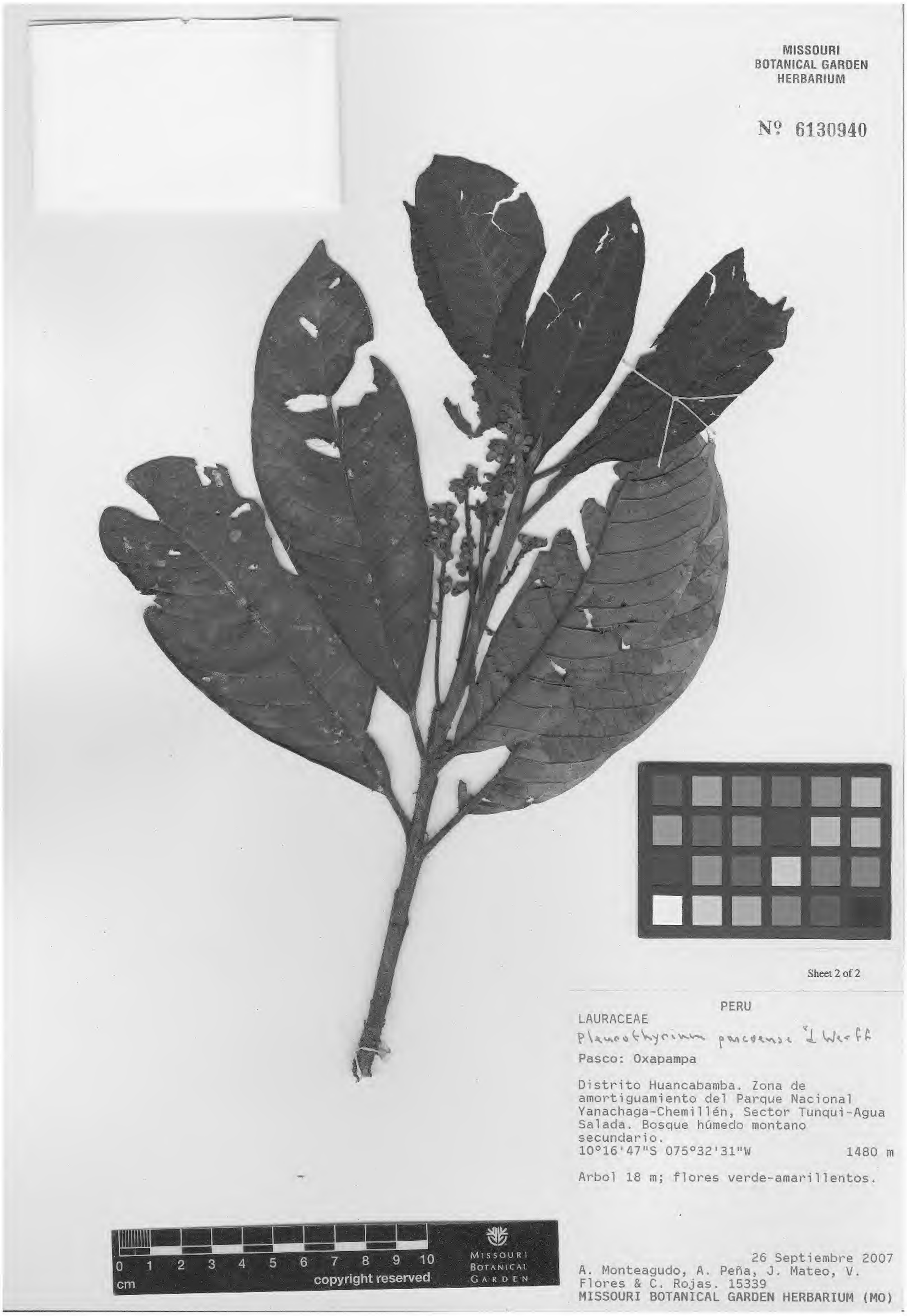

Figure 7. Holotype of *Pleurothyrium pascoense* van der Werff.

completely, wearing off with age; terminal buds densely brown pubescent, the hairs erect and covering the surface completely. Leaves alternate, elliptic, 13–19 × 5–8 cm, subcoriaceous, base acute, apex obtuse or shortly acute, mature leaves glabrous adaxially, young leaves moderately pubescent adaxially, mature leaves with scattered, erect hairs abaxially, these much denser along the midrib and secondary veins; major veins slightly impressed adaxially, prominently raised abaxially, tertiary veins parallel, raised abaxi-

ally, secondary veins 15 to 20 on each side, arching upward near the margin and loop-connected; petioles 9–19 mm, flat or shallowly canaliculate, with a similar indument as the twigs. Inflorescences 7–12 cm, narrowly paniculate-cymose, densely brown pubescent, the hairs erect and completely covering the surface, in the axils of bracts, above last year's mature leaves and below the current year's immature leaves. Flowers densely pubescent, yellow-green, ca. 6 mm diam.; pedicels very short, ca. 1 mm, flowers appearing almost sessile; tepals equal, ca. 3 mm, the margin slightly recurved, the inner surface densely papillose with a few hairs mixed in; outer 6 stamens ca. 1 mm, glabrous, the anther curved toward the pistil, 4-celled, but occasionally 1 or 2 locelli not developed; inner 3 stamens straight, 4-celled, filaments with a few hairs, otherwise glabrous; glands at the base of the inner stamens enlarged, protruding between the stamens, free, not fused in a disc; staminodia of whorl IV not seen; pistil ca. 2 mm, glabrous, style ca. 1 mm; receptacle deep, glabrous inside. Fruits and cupule not known.

Discussion. The affinities of *Pleurothyrium pascoense* are with a small group of species characterized by the presence of half-erect tepals, these often with a recurved margin, and stamen glands that are enlarged but not fused in a disc. Neither brochidodromous venation nor the erect indument on the abaxial leaf surface have been reported for any of the other species in this group. The raised, scalariform tertiary venation is also a distinguishing character for the new species. Four species in this group are fairly common: *P. parviflorum* Ducke, a lowland species of flooded forests with glabrous leaves and fistulose twigs from Bolivia, Brazil, Ecuador, and Peru; *P. trianae* (Mez) Rohwer, known from Venezuela, Colombia, Ecuador, and northern Peru, with appressed pubescence on twigs and inflorescences and usually with fistulose twigs; and *P. cuneifolium* Nees and *P. poeppigii* Nees, two similar species with minute indument on twigs and leaves, fistulose twigs, and large (to 30 cm) leaves. The last two species have a wide distribution and occur in the Cordillera de Yanachaga in Peru. The remaining species in this group are rarely collected and poorly known: *P. acuminatum* van der Werff is known from a few collections in the lowlands of northeastern Peru (Jenaro Herrera) and adjacent Brazil; *P. amapaense* C. K. Allen is known with certainty only from the type collection made in Amapa, Brazil; *P. intermedium* (Mez) Rohwer, which has a sparse, appressed indument, is a lowland species collected a few times in Acre, Brazil, Bolivia, and Peru; *P. undulatum* (Meisner) Rohwer, which has glabrous leaves, is only known from the type collection made in the lower Rio Negro in Amazonian Brazil; and *P. amplifolium* (Mez) Rohwer is only known from the Glaziou type collection from Rio de Janeiro. In leaf characters the new species resembles *P. vasquezii* van der Werff, a lowland species from eastern Peru with spreading tepals, larger glands, and inflorescences clustered in the axils of bracts at the tips of the branches.

IUCN Red List category. *Pleurothyrium pascoense* is known only from the type collection and is listed as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

8. Pleurothyrium triflorum van der Werff, sp. nov. TYPE: Panama. Colón: Teck Cominco Petaquilla mining concession, 08°49′56″N, 080°41′05″W, 250 m, 7 Mar. 2008, *G. McPherson 20452* (holotype, PMA; isotype, MO). Figure 8.

Species nova *Pleurothyrio glabritepalo* van der Werff similis, sed ab eo tepalis aequalibus intus dense papillosis et laminis subtus glabris recedit.

Tree, to 18 m; twigs terete, minutely brown tomentulose, glabrescent; terminal buds densely brown tomentulose. Leaves alternate, elliptic or slightly obovate, 6–12 × 2.5–4.5 cm, chartaceous, base and apex acute, adaxially glabrous, abaxially glabrous or with some curved hairs along the major veins; midrib and secondary veins slightly impressed, tertiary venation immersed adaxially, midrib and secondary veins raised, tertiary venation immersed abaxially, secondary veins 5 to 7, the distal ones loop-connected; petioles 9–16 mm, flat above, with an indument similar to the twigs. Inflorescences 1–1.5 cm, 3-flowered, in the axils of bracts immediately below the terminal buds, densely brown tomentulose. Flowers 8–10 mm diam.; pedicels ca. 3 mm; tepals equal, rotate, ca. 3.5 × 2 mm, the outer surface brown tomentulose, inner surface densely gray papillose; stamens 9, all 4-celled, the locelli lateral, glands strongly enlarged, fused or nearly so, forming a disc ca. 3 mm diam. surrounding the stamens; receptacle pubescent inside; ovary globose, the lower 2/3 pubescent. Fruit and cupule not known.

Discussion. Several other species of *Pleurothyrium* have few-flowered inflorescences like *P. triflorum*. Among those are *P. glabritepalum*, which differs in having unequal tepals, the inner surface of the tepals glabrous, and a pilose indument on the abaxial leaf surface, and *P. pauciflorum* van der Werff & Hammel, which differs in its larger leaves (16–35 cm) with 14 to 20 pairs of lateral veins and an erect indument on the abaxial leaf surface. The inflorescences of *P. pauciflorum* are not strictly 3-flowered as they are in *P. glabritepalum* and *P. triflorum*.

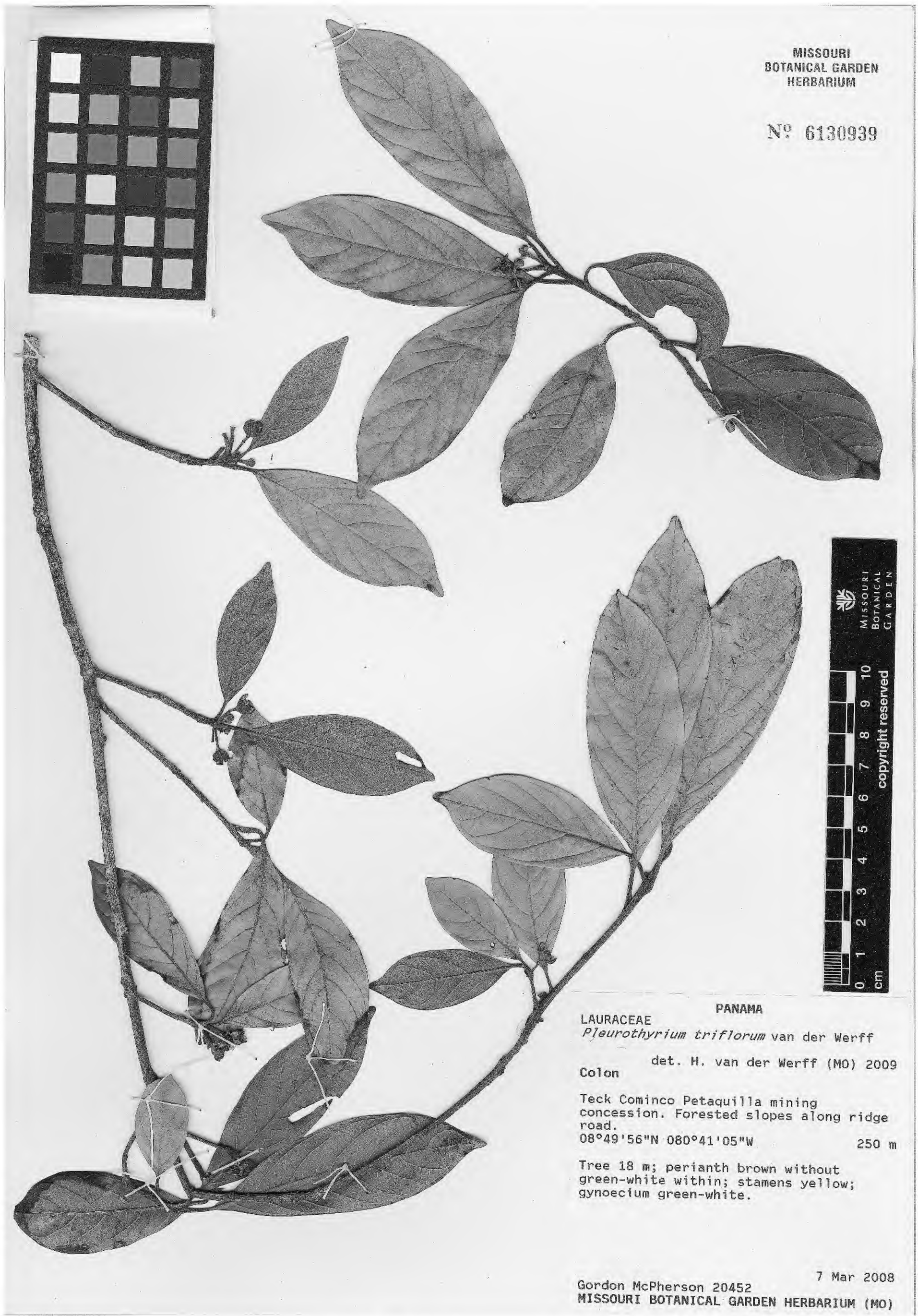

Figure 8. Isotype of *Pleurothyrium triflorum* van der Werff.

IUCN Red List category. *Pleurothyrium triflorum* is only known from the type collection and is assessed as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Acknowledgments. Fieldwork in the Cordillera del Cóndor was supported by grant #0346679 from the National Science Foundation (principal investigator, David Neill).

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Sorocea carautana (Moraceae): A New Species from Southeastern Brazil

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Abstract. A new species of *Sorocea* A. Saint-Hilaire, *S. carautana* M. D. M. Vianna, Carrijo & Romaniuc (Moraceae s. str.), was discovered in the hills of southern Rio de Janeiro in the vicinity of Paraty. The new species resembles *S. hilarii* Gaudichaud by the similar shape of the leaves, but is clearly distinguished by its longer pistillate pedicel. This new species is endemic to the Atlantic Forest and is threatened due to its restricted geographic area of occurrence.

Resumo. Uma nova espécie de *Sorocea* A. Saint-Hilaire, *S. carautana* M. D. M. Vianna, Carrijo & Romaniuc (Moraceae s. str.), foi descoberta nos maciços do sul do estado do Rio de Janeiro, no município de Paraty. A nova espécie assemelha-se a *S. hilarii* Gaudichaud pela forma das folhas, porém é claramente distinta pelo comprimento das inflorescências pediceladas. A nova espécie é endêmica da Floresta Atlântica, e encontra-se ameaçada devido a sua distribuição geográfica restrita.

Key words: Brazil, IUCN Red List, Moraceae, Rio de Janeiro, *Sorocea*.

Sorocea A. Saint-Hilaire is an exclusively Neotropical genus, and its range extends from Argentina to Mexico. The genus contains around 25 species (Romaniuc Neto, 1998) and is principally characterized by dioecious trees or shrubs. Recent treatments of *Sorocea* have been offered by Burger et al. (1962), Romaniuc Neto (1998, 1999), and Berg (2001). This last author recognized a species group comprising taxa with a spinulose dentate leaf margin as somewhat distinct from the rest of the genus. The new species belongs to this complex, and its characters are described and illustrated here.

Sorocea carautana M. D. M. Vianna, Carrijo & Romaniuc, sp. nov. TYPE: Brazil. Rio de Janeiro: Paraty, APA do Cairuçu, Morro do Carrapato, 23°01′S, 44°03′W, 150 m, 9 Dec. 1993, *R. Marquete 1405* (holotype, RB; isotype, US). Figure 1.

Haec species quoad foliorum formam ad *Soroceam hilarii* Gaudichaud proxime accedit, sed ab ea floris feminei pedicello in fructu usque ad 1.7–3.2 cm elongata et foliis margine integris vel paucispinulosis differt.

Shrub or tree, 7–10 m tall, bark smooth, gray to brownish; leafy twigs 1–4 mm diam., sparsely puberulent or glabrous, striate; lenticels conspicuous; leaf scars plane. Leaf lamina oblong to lanceolate, 8.7–12.5 × 2.2–3 cm, slightly unequal, coriaceous, discolorous, apex caudate, acumen not spinulose, base asymmetric, acute to obtuse, margin usually entire, sometimes with few spines; adaxial blade surface glabrous, shiny, abaxial surface sparsely puberulent, opaque; leaf venation brochidodromous, impressed on the midrib adaxially, prominent abaxially, lateral veins in 8 to 13 pairs, tertiary venation mostly reticulate; petiole 5–8 × 0.7–1.5 mm, puberulent; stipules 2–4 mm, puberulent to glabrous, caducous. Staminate inflorescences unknown. Pistillate inflorescences racemose, 10 to 13 flowers per inflorescence, 5.5–8.5 cm, rachis puberulent, carnose; peduncle 3.5–4.5 cm, puberulent. Pistillate flowers 1.2–1.5 mm, upper perianth with a cupuliform ring, sparsely hispidulous, the lower portion mostly densely hispidulous; stigma bifurcate, finely papillate; pedicel 1–1.2 cm, sparsely puberulent to hispidulous, swollen and red in fruit. Fruiting perianth ovoid, 0.5–1 cm, surface smooth, sparsely puberulent, red to black; pedicel elongating to 1.7–3.2 cm, sparsely puberulent to almost glabrous.

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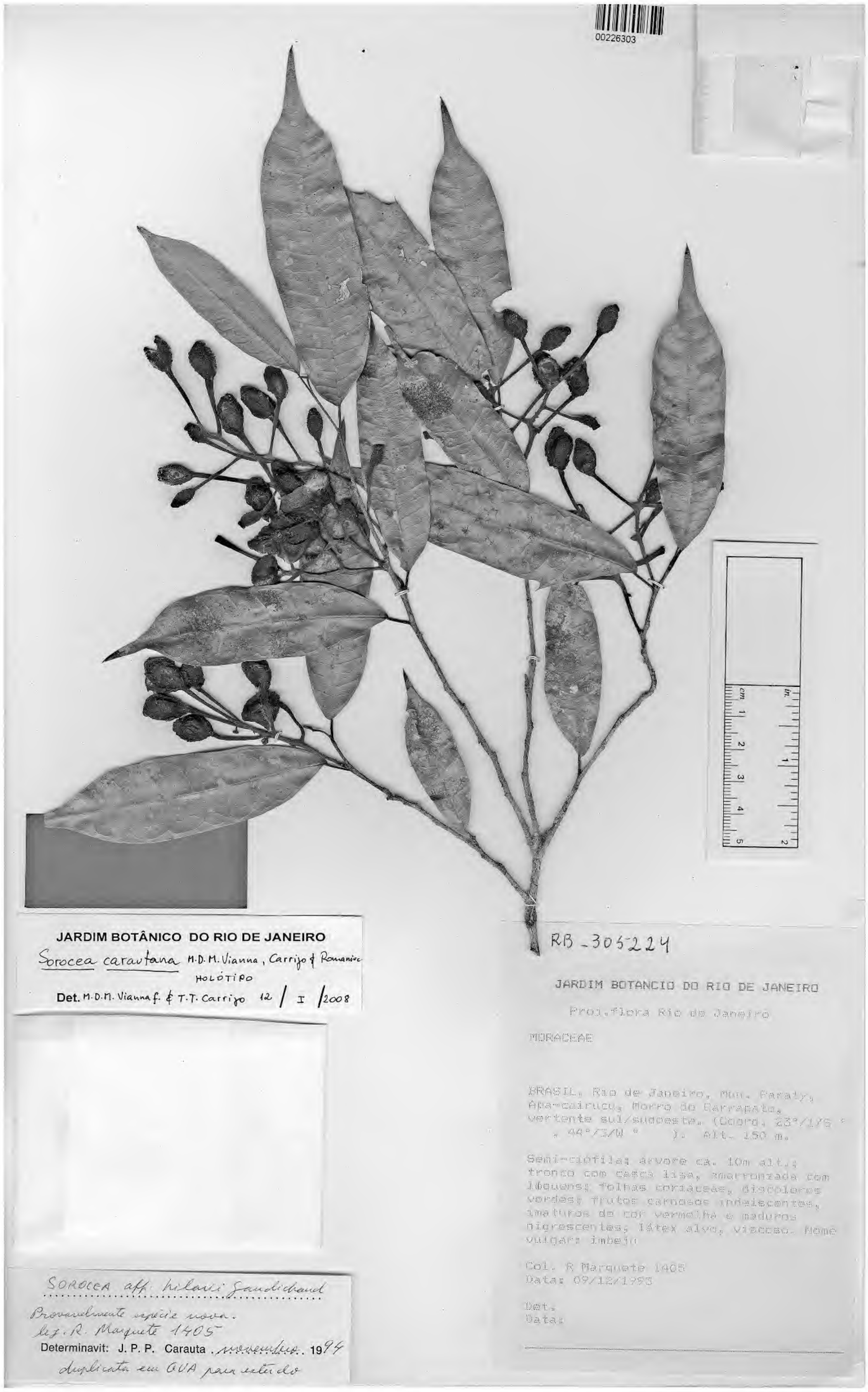

Figure 1. Holotype specimen of *Sorocea carautana* M. D. M. Vianna, Carrijo & Romaniuc (*R. Marquete 1405*, RB).

Distribution and habitat. The new species is restricted to the coastal region of Rio de Janeiro State and is known only from the Environmental Protection Area of Cairuçu, in tropical humid forest of the Serra do Mar from elevations of 150–300 m (23°10′–23°23′S, 44°30′–44°51′W).

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), this species is considered Critically Endangered (CR B1a) based on its area of occupancy estimated at less than 100 km². The new species is known only from Paraty municipality, Rio

de Janeiro State, where the population is sparsely distributed in the undergrowth of humid forest.

Etymology. The specific epithet *carautana* was chosen to honor Pedro Carauta, who first recognized this species as possibly new.

Discussion. *Sorocea carautana* belongs to *Sorocea* subgen. *Sorocea* based on the long internodes in the leaf stems, plane leaf scars, inconspicuous axillary buds, distinctly racemose inflorescences (or spicate elsewhere in the subgenus), and bracts that range from subcoriaceous to coriaceous. The new species resembles *S. hilarii* Gaudichaud by the similar shape of the leaves, but is clearly distinguished by the fruiting perianth pedicel length (1.7–3.2 cm vs. to 1.2 cm in *S. hilarii*).

Additional field data show that *Sorocea carautana* has smooth bark, a discolorous leaf blade, reddish pistillate peduncles, and nigrescent fruiting perianths. These observations are supported from field data on labels.

Paratypes. BRAZIL. **Rio de Janeiro:** Paraty, Laranjeiras, estrada nova para Praia do Sono, 8 Dec. 1993, *R. Marquete 1369* (RB); Paraty, Km 165, Rio-Santos, Faz. São Roque, 13 Dec. 1988, *M. Nadruz 455* (RB); Paraty, Saco de Mamanguá, 27 Apr. 1993, *R. Marquete 855* (RB); Paraty, Alagado Olaria, APA-Cairuçu, 16 Mar. 1993, *M. C. Marques 329* (RB); Paraty, APA-Cairuçu, Morro do Carrapato, 9 Dec. 1993, *R. Marquete 1405* (RB); Paraty, 11 May 1994, *R. Marquete 1784* (RB).

Acknowledgments. The authors are grateful to Jorge Pedro Pereira Carauta for correcting the Latin diagnosis.

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A New Hysteranthous Species of *Chelonopsis* (Lamiaceae) from Southwest China

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Abstract. A new species, *Chelonopsis praecox* Weckerle & F. Huber (Lamiaceae, Lamioideae) from southwest China, is described and illustrated, and its relationship to morphologically similar species is discussed. *Chelonopsis praecox* differs from the other species of the genus by its characteristic to bear flowers and fruits in springtime and early summer, before the development of leaves during the summer rainy season, while all other *Chelonopsis* species flower during summer or autumn. Prominent distinguishing morphological features are found in the stem bark, leaf size and indumentum, and inflorescences. So far, the species is only known from the northern part of the Shuiluo Valley in southwest Sichuan; additional collections are necessary to clarify its full distributional range.

Key words: *Chelonopsis*, China, Himalayas, IUCN Red List, Lamiaceae, Lamioideae.

Chelonopsis Miquel (Lamiaceae) includes approximately 16 species distributed in East Asia, and of these, 13 occur in China (Li & Hedge, 1994; Mabberley, 1997). The genus is currently placed in the subfamily Lamioideae (Harley et al., 2004). It was formerly placed in the subtribe Melittidinae, together with five North American genera (*Brazoria* Engelmann & A. Gray, *Warnockia* M. W. Turner, *Macbridea* Rafinesque, *Physostegia* Bentham, and *Synandra* Nuttall) and the monotypic European genus *Melittis* L. (Cantino, 1985; Wagstaff et al., 1995; Turner, 1996). However, Scheen et al. (2008) showed that the above circumscription of the subtribe Melittidinae is polyphyletic. While the North American genera form a monophyletic group, the placement of *Melittis* and *Chelonopsis* needs further investigation.

Chelonopsis comprises herbs and shrubs with 2-lipped, white to yellow or purple-red flowers, bearing characteristic anthers with bearded pollen sacs. The 13 species distributed in China have been partly revised for the English version of the *Flora of China* (Li & Hedge, 1994), but a complete revision of the genus is lacking to date.

In this paper, a new species is described that is morphologically similar to *Chelonopsis forrestii* J. Anthony, *C. mollissima* C. Y. Wu, and *C. rosea* W. W. Smith. An overview of the discriminating characters of these four species is provided.

Materials and Methods

This study is based on the morphological analysis of plant material collected in the Shuiluo Valley, Muli County, Liangshan Prefecture, Sichuan Province, People's Republic of China, as well as herbarium specimens from the herbarium of the Kunming Institute of Botany, Chinese Academy of Sciences (KUN). A list of the specimens examined is given in Table 1. For the description of the new species, 10 individuals were investigated, and for each individual 10 to 21 leaves were measured, for a total of 128 measurements. Leaf and petiole sizes provided correspond to the interdecile range; minimum and

Table 1. Morphological comparison of *Chelonopsis praecox* with *C. forrestii*, *C. mollissima*, and *C. rosea*.[1]

Character	*C. praecox*	*C. forrestii*	*C. mollissima*	*C. rosea*
Habitat	dry thickets and streamside thickets; 2000–2400 m; Sichuan	forests and streamside thickets; 2500–3100 m; Yunnan and Sichuan	dry thickets on open slopes in valleys; 1200–2500 m; Yunnan and SW Sichuan	Open thickets; 1500–3100 m; Yunnan
Habit	shrubs 1–3 m tall	shrubs 1–2 m tall	shrubs ca. 1 m tall	shrubs 1–2.5 m tall
Stems	stems straw-colored, bark peeling	stems straw-colored to yellow-brown, bark peeling	branches straw-colored to brown, with longitudinal fissures	branches straw-colored to brown, bark not peeling
Stem indumentum	very densely pilose, few glands	sparsely pubescent to subglabrous	densely pilose, sometimes with branched hairs	densely villous, with glandular hairs
Leaf shape	leaf blade broadly ovate, base subcordate to cordate, apex short acuminate to acute, sometimes with additional leaflets on petiole	leaf blade ovate-lanceolate, base slightly asymmetrical, acute to rounded or cordate, apex acute to acuminate	leaf blade ovate, base cordate to subcordate or obtuse to rounded, apex acute	leaf blade broadly ovate, base cordate to rounded, apex acute to acuminate
Leaf margin	shallowly serrate to serrate-crenate	shallowly serrate to subentire, ciliate	coarsely serrate-crenate	serrate-crenate to biserrate
Leaf size	(3.8–)5.4–9.7(–11.2) × (2.7–)4–6.8(–8.5) cm	4–7.5(–15) × 1.5–3(–5) cm	3–6 × 2.5–4.5 cm	3–9 × 2–5.5 cm
Leaf indumentum	densely pilose adaxially, very densely pilose and glandular abaxially	sparsely pubescent adaxially, sparsely pubescent and glandular abaxially	densely pilose, sometimes with branched hairs, sometimes with glands	villous and glandular adaxially, densely so mainly along veins abaxially
Petiole	(1–)1.5–4.8(–6.8) cm	3–5(–7) mm	1–3(–5) cm	1–4.5 cm
Inflorescence	cymes 1(2)-flowered	cymes 1-flowered	cymes 1- to 3-flowered	cymes usually 3-flowered
Bracteoles	ovate to elliptic, 4–6 × 2–3 mm	linear, ca. 5 mm	ovate to oblanceolate to linear, 2–7 × 0.5–3 mm	mainly linear, 4–8 mm
Calyx indumentum	densely pubescent with glandular hairs externally, glabrous internally	with sparse white cilia externally, glabrous internally	externally and internally puberulent	pubescent externally, glabrous except for pubescent teeth internally
Corolla color	creamy white, tinged purple or red-purple spotted	creamy white with purple to purple or red, with purple lines on tube or purple spotted	white with tip of upper lip faint red to rose to red	rose to purple
Phenology	flowering March, fruiting June	flowering June–August	flowering October–December	flowering August–December, fruiting September–December

[1] The data in the table are based on Li and Hedge (1994) and the following herbarium specimens: *Chelonopsis forrestii* Anthony. CHINA. **Sichuan:** Litang Valley, June 1922, *Forrest 21356* (E holotype [photo]); Muli, 23 Aug. 1983, *Qing T. D. 13290* (KUN). **Yunnan:** s. loc., 18 June 1937, *Yü T. T. 6409* (KUN); s. loc., 10 July 1937, *Yü T. T. 6970* (KUN); s. loc., *Anonymous 3716* (KUN). *Chelonopsis mollissima* C. Y. Wu. CHINA. **Yunnan:** Luquan (xian), Zhongping (xiang), Jiangbian (cun), 12 Nov. 1952, *Mao P. Y. 01727* (KUN holotype); Luquan (xian), Zhongping (xiang), Jiangbian (cun), 12 Nov. 1952, *Mao P. Y. 01728* (KUN); Huize (xian), Jiduo (xiang), Yinchangpu (cun), 19 Dec. 1952, *Mao P. Y. 02037* (KUN); Lijiang, nearby Shang Fengke, 3 Oct. 1983, *Qing T. D. 14940* (KUN). **Sichuan:** Muli, Shuiluo Valley, 28 Sep. 2005, *Weckerle & Huber 050928-1/1* (KUN, Z). *Chelonopsis rosea* W. W. Smith. CHINA. **Yunnan:** Dali region, Aug. 1913, *Forrest 11682* (E holotype [photo]); Jing-Dong, Hua Shan, 10 Dec. 1939, *Li M. K. 2371* (KUN), 11 Dec. 1939, *Li M. K. 2392* (KUN); Meng Hua, near Wuliang Shan, 26 Sep. 1933, *Tsiang Y. 12073* (KUN); Shunning, Litah, 10 Sep. 1938, *Yü T. T. 17603* (KUN); Mienning, Taniuchuan, 13 Nov. 1938, *Yü T. T. 18204* (KUN); Gengma, along rd. from Mengsa to Xiaohaokeng, 3 Dec. 1958, *Zhu T. P. 0451* (KUN).

maximum measured values are provided in parentheses.

Results and Discussion

Chelonopsis praecox Weckerle & F. Huber, sp. nov. TYPE: China. Sichuan: Muli Co., Shuiluo Valley, vic. of Lanman village along roadside, 28°19′58.9″N, 100°39′29″E, 2210 m, 15 Mar. 2005 (fl.), *C. S. Weckerle & F. K. Huber 050315-1/1* (holotype, Z; isotype, KUN). Figure 1.

Haec species ab omnibus speciebus ceteris generis *Chelonopsidis* Miquel florescentia verna (foliis hysteranthis) distincta; etiam a *C. forrestii* J. Anthony petiolo longiore, foliis late ovatis atque bracteolis ovatis ellipticisve, a *C. mollissima* C. Y. Wu habitu altiore atque calyx intus glabro, a *C. rosea* W. W. Smith flore cremeo, a *C. forrestii* et *C. mollissima* foliis majoribus, a *C. forrestii* et *C. rosea* foliis dense pilosis, a *C. mollissima* et *C. rosea* cortice exfoliato atque cymis unifloris distinguitur.

Shrub 1–3 m tall, branches subterete to terete, straw-colored, bark peeling; young branches very densely pilose with few glands. *Leaf* blade broadly ovate, (3.8–)5.4–9.7(–11.2) × (2.7–)4–6.8(–8.5) cm, base subcordate to cordate, apex short acuminate to acute, densely pilose adaxially, very densely pilose abaxially, glandular (aromatic), margin shallowly serrate to serrate-crenate; petiole (1–)1.5–4.8(–6.8) cm, sometimes bearing small leaflets. *Inflorescence* cymose, solitary or paired, or terminal on leafy axillary branchlets, 1(2)-flowered; bracteoles 2, ovate to elliptic, 4–6 × 2–3 mm, densely pilose. *Calyx* tubular-campanulate, teeth 5, triangular, apex acute to attenuate, externally densely pubescent, with glandular hairs, internally glabrous, 1.6–1.9 cm long in flower (tube 0.9–1 cm), 1.7–2.3 cm long in fruit (tube 1.2–1.6 cm); *corolla* creamy white, tinged purple or red-purple spotted, externally densely pubescent, internally glabrous, 2.8–3.5 cm (tube 2.3–2.5 cm), upper lip ca. 3 × 9 mm, entire, middle lobe of lower lip ca. 7 × 5–6 mm, subentire, lateral lobes 2–3 × 5–6 mm; *stamens* with bearded pollen sacs and puberulent filaments; *style* equally 2-cleft. *Nutlets* straw-colored to brown, oblong, 1–1.4 × 0.2–0.4 cm, winged at apex, finely striate.

Distribution and habitat. *Chelonopsis praecox* is known only from the northern part of the Shuiluo Valley, Muli County, southwest Sichuan, People's Republic of China, and is frequently found in streamside thickets at altitudes from 2000–2400 m. Additional collections are necessary to clarify its full distributional range.

IUCN Red List category. Due to the lack of distributional data for *Chelonopsis praecox* outside the Shuiluo Valley, it seems appropriate to assign a conservation status of Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Chelonopsis praecox* has been collected in flower in March and in fruit in June. The species flowers during springtime, while leaves are produced at the beginning of the rainy season starting in the area in June or July.

Etymology. The specific epithet recognizes the characteristic of the new species to bear flowers before leaves, a unique feature in the genus *Chelonopsis*.

Discussion. The flowering and fruiting season of *Chelonopsis praecox* is confined to spring and early summer, followed by the development of the leaves during the summer rainy season. For *Chelonopsis*, this phenological feature is exclusively found in the new species described here. Therefore, we prepared a holotype consisting of a flowering specimen and a paratype consisting of a leaf-bearing specimen (*Weckerle & Huber 050925-1/1* [Z], see Figs. 2 and 3). All other species of *Chelonopsis* flower and fruit during summer or autumn, when their leaves are fully developed (Hedge, 1990; Murata & Yamazaki, 1993; Li & Hedge, 1994).

Chelonopsis praecox is morphologically similar to *C. forrestii*, *C. mollissima*, and *C. rosea*. However, it is the only species of this group that shows a seasonal pattern of flower and leaf development. From *C. forrestii* it differs mainly by its habitat at 2000–2400 m (vs. 2500–3100 m), densely pilose stem and leaves (vs. sparsely pubescent), larger leaves and longer petioles, broadly ovate leaf shape (vs. ovate-lanceolate), and ovate to elliptic bracteoles (vs. linear); from *C. mollissima* it differs by its taller habit (1–3 m vs. ca. 1 m), peeling bark, larger leaves, 1(2)-flowered cymes (vs. 1- to 3-flowered), and the calyx internally glabrous (vs. puberulent); and from *C. rosea* it differs by its peeling bark, densely pilose leaves (vs. villous), 1(2)-flowered cymes (vs. 3-flowered), and creamy white flowers (vs. rose to purple).

A detailed comparison of the new species with the three morphologically similar species is given in Table 1. The data are based on Li and Hedge (1994) and have been amended according to the herbarium specimens listed in Table 1, particularly for the following characters: habitat, habit, stem indumentum, leaf shape, leaf size, leaf indumentum, petiole, bracteoles, and phenology.

Paratypes. CHINA. **Sichuan:** Muli, Shuiluo Valley, vic. Lanman village in small valley to Shuiluo River, 28°19′50.6″N, 100°39′40.2″E, 2140 m, 25 Sep. 2005 (mature leaves), *C. S. Weckerle & F. K. Huber 050925-1/1*

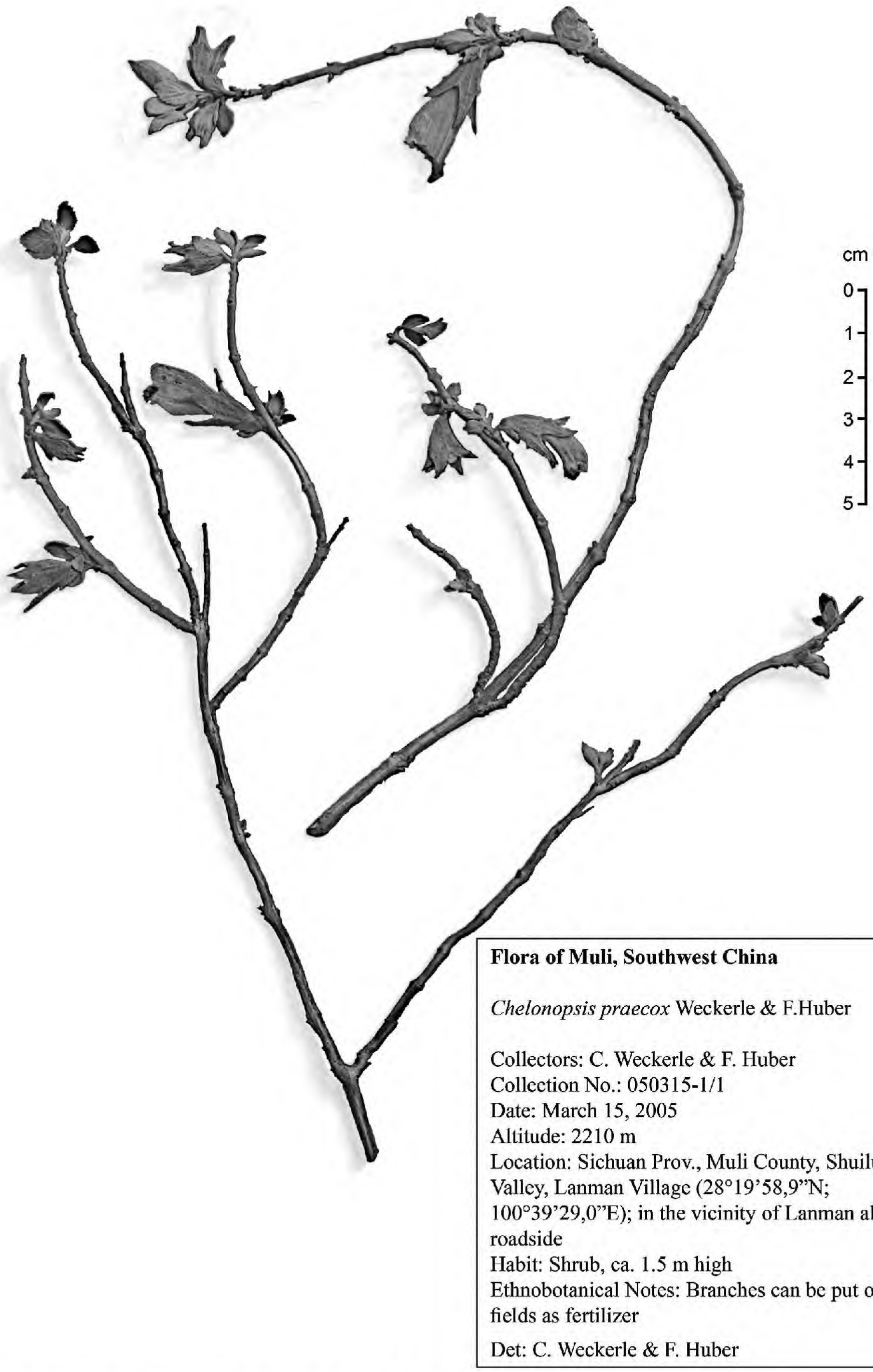

Figure 1. Holotype of *Chelonopsis praecox* Weckerle & F. Huber (*Weckerle & Huber 050315-1/1*, Z).

Flora of Muli, Southwest China

Chelonopsis praecox Weckerle & F.Huber

Collectors: C. Weckerle & F. Huber
Collection No.: 050925-1/1
Date: September 25, 2005
Altitude: 2140 m
Location: Sichuan Prov., Muli County, Shuiluo Valley, Lanman Village (28°19'50,6"N; 100°39'40,2"E); in a small valley leading to the Shuiluo River
Habit: Shrub, up to 2.5 m high
Notes: Leaves fragrant (*Citrus*- or *Geranium*-like), flowering before rain season

Det: C. Weckerle & F. Huber

Figure 2. Paratype of *Chelonopsis praecox* Weckerle & F. Huber (*Weckerle & Huber 050925-1/1*, Z).

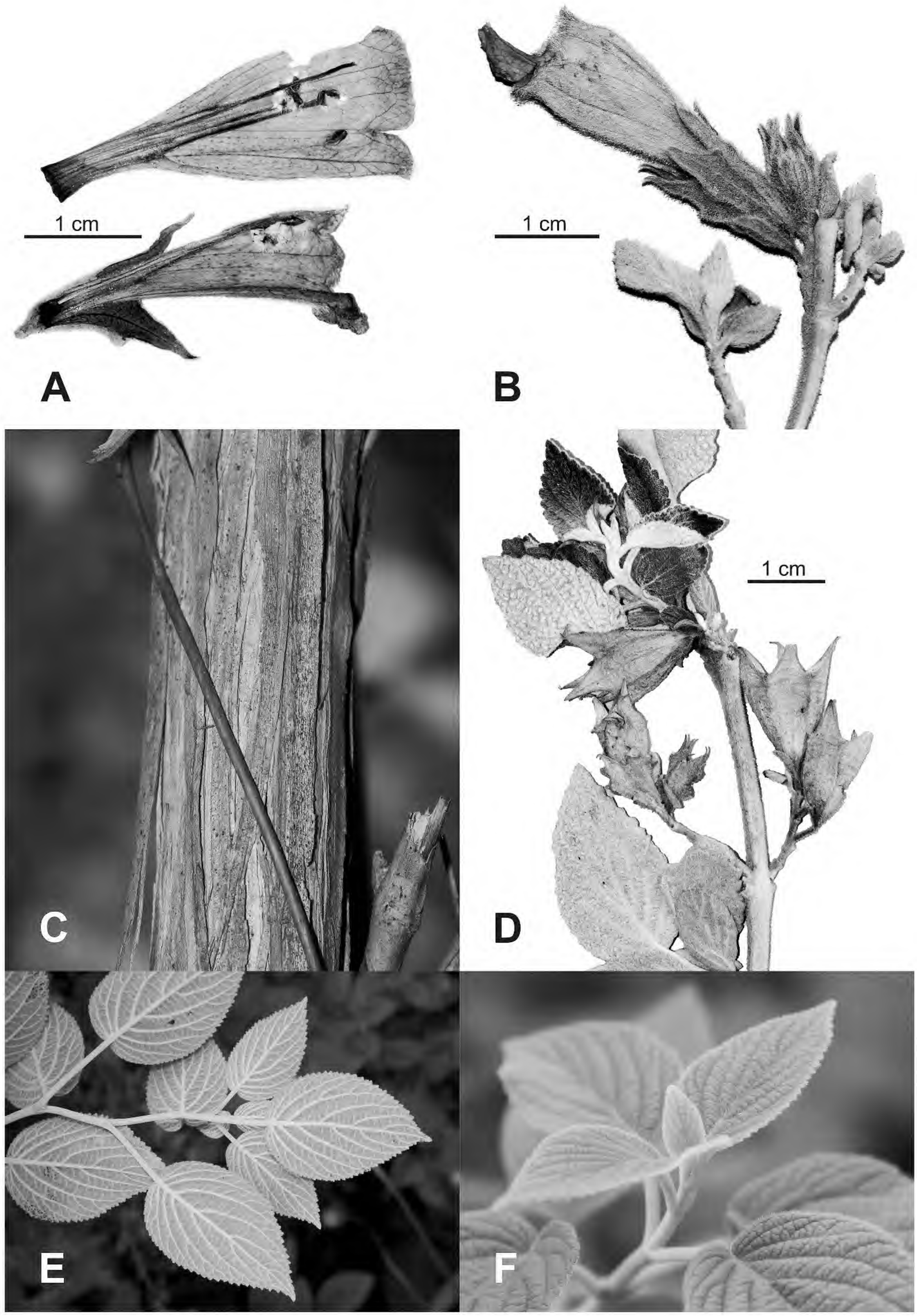

Figure 3. Photos of the new species *Chelonopsis praecox* Weckerle & F. Huber. —A. Longitudinal section of two dry flowers, showing the bearded anthers. —B. Flower. —C. Peeling bark of the stem. —D. Fruits and emerging leaves. —E. Leaves, abaxial view. —F. Leaves, adaxial view. A, B from the holotype *C. Weckerle & F. Huber 050315-1/1* (Z); D from the paratype *C. Weckerle & F. Huber 040604-2/1* (Z).

(Z), *050925-1/2* (Z), *050925-1/3* (Z); Muli, Shuiluo Valley, 4 June 2004, *C. S. Weckerle & F. K. Huber 040604-2/1* (Z); Muli, Shuiluo Valley, 11 June 2004, *C. S. Weckerle & F. K. Huber 040611-1/1* (KUN, Z).

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Chiritopsis jingxiensis, a New Species of Gesneriaceae from a Karst Cave in Guangxi, China

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Abstract. *Chiritopsis* W. T. Wang (Gesneriaceae) is endemic to China, where the genus consists of 10 species and three varieties. In the course of our floristic investigation of karst caves in Guangxi in 2005, the new species *C. jingxiensis* Yan Liu, W. B. Xu & H. S. Gao was discovered in a karst cave from the Guangxi Zhuang Autonomous Region of China, and the new taxon is described and illustrated here. This new species is similar to *C. mollifolia* D. Fang & W. T. Wang in its leaf shape, corolla, and staminodes, but it can be distinguished by its smaller leaves, the lax, 1-branched cymes with one to three flowers, and the capsule that is twice as long as the calyx.

Key words: China, *Chiritopsis*, Gesneriaceae, Guangxi, IUCN Red List.

Chiritopsis W. T. Wang (Gesneriaceae) is an endemic genus of 10 species and three varieties found exclusively in China. The genus consists of the one species, *C. xiuningensis* X. L. Liu & X. H. Guo, distributed in Anhui Province; three species and one variety in Guangdong Province; and six species and two varieties in Guangxi Zhuang Autonomous Region. The karst region of Guangxi–Guangdong may be the center of distribution and diversification of *Chiritopsis*.

In the course of floristic investigation of karst caves in 2005, we discovered a rare plant in Jingxi County, southwestern Guangxi, China, identified as belonging to the genus of *Chiritopsis*. After consulting local and national floras and relevant literature (Wang, 1981, 1982, 1986, 1990, 1992; Liu & Guo, 1989; Fang et al., 1993; Wang et al., 1998; Li & Wang, 2004; Liu et al., 2006; Wen et al., 2008) as well as herbarium specimens, we determined the plant to represent a new species, which is described here.

Chiritopsis jingxiensis Yan Liu, W. B. Xu & H. S. Gao, sp. nov. TYPE: China. Guangxi Zhuang Autonomous Region: Jingxi Co., on moist limestone rock face in karst cave, 17 Aug. 2005, *Yan Liu, Wei-bin Xu & Hai-shan Gao L1260* (holotype, IBK; isotype, PE). Figure 1.

Haec species *Chiritopsi mollifoliae* D. Fang & W. T. Wang affinis, sed ab ea lamina foliari minore (1–2 × 0.5–1 vs. 2–4.8 × 2–4.5 cm) basi attenuata vel cuneata (vs. rotundata vel cordata), cymis semel ramosis (vs. bis terve ramosis), stigmate 2-lobulato (vs. integro) atque capsula calyce 1-plo longiore (vs. subaequilonga) differt.

Herbs perennial, stemless; rhizome 5–15 × 3–4 mm diam. Leaves 7 to 17, basal, carnose, papery when dry; petiole flattened, 6–20 × 1–2 mm, villous; blades obovate or elliptic to suborbicular, 1–2 × 0.5–1 cm, villous, base attenuate to cuneate, margin subentire, apex obtuse to subrounded; lateral veins 2 or 3, inconspicuous. Cymes lax, 2 to 5 per rosette, axillary, 1-branched, each 1- to 3-flowered; peduncle 3–6 cm, pubescent; bracts 2, opposite, linear-lanceolate, 1–2 × 0.3–0.5 mm, margin entire, pubescent; pedicel 5–15 mm, pubescent. Calyx 5-lobed, dissected to near base, segments narrowly linear-lanceolate, 3–3.5 × 0.5–1 mm, apex acute, externally pubescent, internally sparsely puberulent, margins entire; corolla purplish, 10–13 mm, externally pubescent, internally sparsely puberulent; corolla tube ca. 9 × 4 mm; limb distinctly 2-lipped, white; adaxial lip ca. 2 mm, 2-parted to base, lobes 2.5–3 mm wide; abaxial lip 3–4 mm, 3-parted to near middle, lobes rounded-ovate, 3–3.5 mm wide; stamens 2, adnate to 2.5–3 mm above corolla base; filaments lanceolate-subulate, 3–4 mm, ± geniculate near middle, glabrous; staminodes 2, ca. 1.5 mm, glabrous, linear, apex capitate, adnate to 1.5–2 mm above corolla base. Disc annular, ca. 0.7 mm in height, glabrous; pistil ca. 8 mm, ovary narrowly ovoid, 2–3 × ca. 1 mm, puberulent; style 5–6 mm, puberulent; stigma obtrapeziform, ca. 0.5 mm, 2-lobed. Capsule ellipsoidal, 6–8 × 1.5–2 mm, twice as long as calyx.

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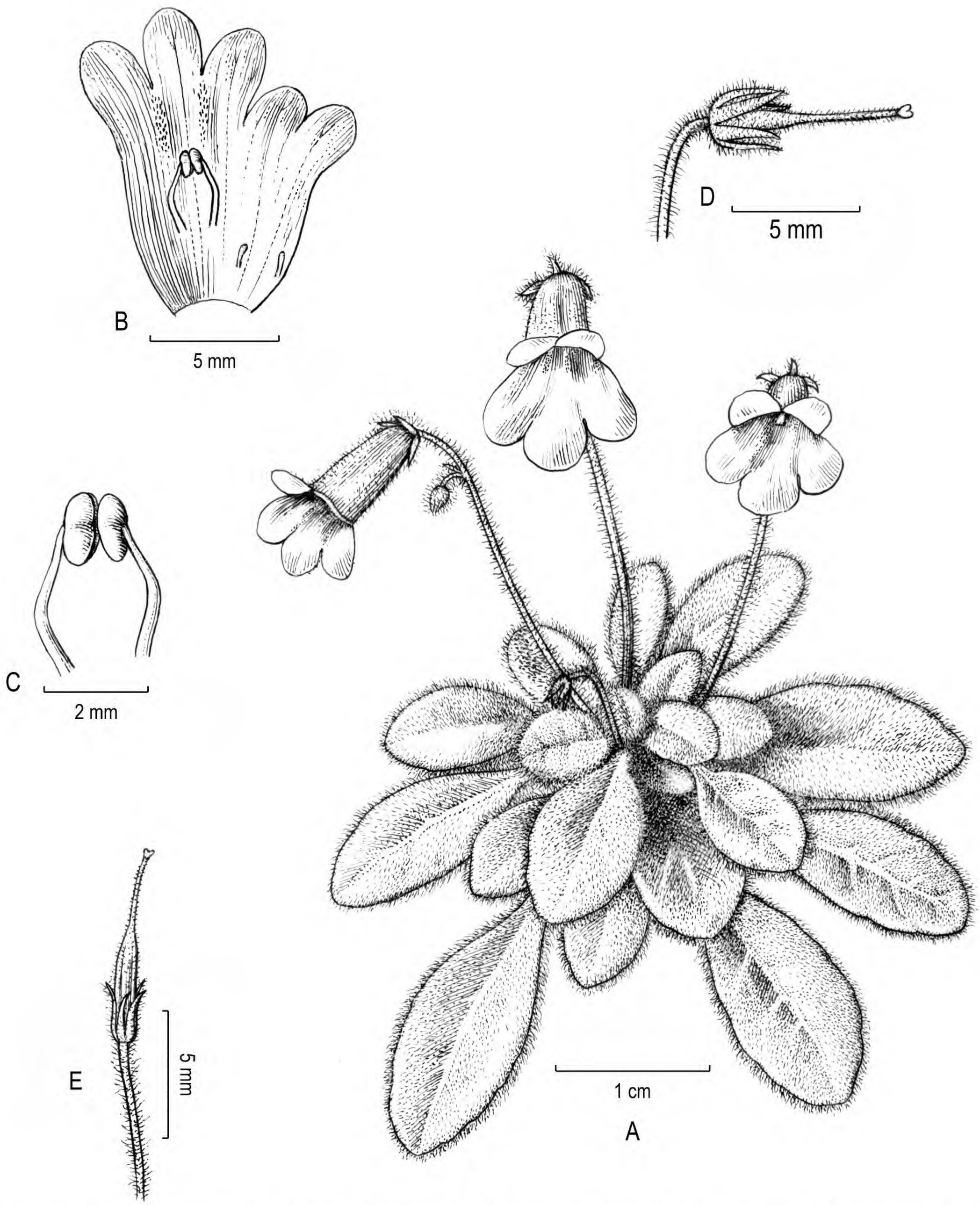

Figure 1. *Chiritopsis jingxiensis* Yan Liu, W. B. Xu & H. S. Gao. —A. Habit. —B. Corolla opened with stamens and staminodes. —C. Stamens. —D. Calyx and pistil. —E. Fruit. Drawn by S. Q. He from the holotype *Yan Liu et al. L1260* (IBK).

Distribution and ecology. *Chiritopsis jingxiensis* is known only from one population on moist limestone rock face in a karst cave in Jingxi County, southwestern Guangxi, China, at ca. 900 m.

IUCN Red List category. The new species has an estimated population size of fewer than 250 mature individuals and is known only from one site. We therefore assess *Chiritopsis jingxiensis* as Critically Endangered (CR) according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Chiritopsis jingxiensis* has been collected in flower from July to September and in fruit from August to October.

Table 1. Morphological comparison of *Chiritopsis jingxiensis*, *C. mollifolia*, and *C. xiuningensis*.

	C. jingxiensis	*C. mollifolia*	*C. xiuningensis*
Leaf blade (cm)	1–2 × 0.5–1	2–4.8 × 2–4.5	2–9 × 1–6
Leaf base	attenuate to cuneate	rounded to cordate	widely cuneate, shallowly cordate to subrounded
Cymes	2 to 5, single-branched, with 1 to 3 flowers	cymes 4 to 10, 2- or 3-branched, with 7 to 20 flowers	cymes 1 to 7, 1- or 2-branched, with 2 to 10 flowers
Corolla limb	distinctly 2-lipped, with the adaxial lip ca. 2 mm, the abaxial lip ca. 3–4 mm	distinctly 2-lipped, with the adaxial lip ca. 2.2 mm, the abaxial lip ca. 3 mm	obscurely 2-lipped, with the adaxial lip ca. 3 mm, the abaxial lip ca. 2 mm
Staminodes	apex capitate	apex capitate	apex not capitate
Disc	annular	annular	2-lobed
Stigma	2-lobed	not divided	2-lobed
Capsules	twice as long as calyx	not exceeding calyx	not exceeding calyx

Etymology. The specific epithet commemorates Jingxi County, the type locality for the new species.

Relationships. *Chiritopsis jingxiensis* is similar to *C. mollifolia* D. Fang & W. T. Wang in its leaf shape, corolla, and staminodes, but it can be distinguished by its smaller leaves (1–2 × 0.5–1 cm vs. 2–4.8 × 2–4.5 cm), attenuate to cuneate leaf base (vs. rounded to cordate), cymes two to five, 1-branched, with one to three flowers (vs. cymes four to 10, 2- or 3-branched, with seven to 20 flowers), 2-lobed stigma (vs. not divided), and capsules that are twice as long as the calyx (vs. not exceeding calyx). Table 1 summarizes the morphological differences between *C. jingxiensis* and two similar species.

Paratypes. CHINA. **Guangxi Zhuang Autonomous Region:** Jingxi Co., 17 Aug. 2005, *Yan Liu, Wei-bin Xu & Hai-shan Gao L1261* (MO), 19 Sep. 2006, *Yan Liu & Wei-bin Xu L1380* (IBK).

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Impatiens cornutisepala (Balsaminaceae), a New Species from Guangxi, China

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Abstract. A new species from Guangxi Province, *Impatiens cornutisepala* S. X. Yu, Y. L. Chen & H. N. Qin, is described for the Balsaminaceae in China. It is similar to *I. dicentra* Franchet ex Hooker f. in the 1-flowered peduncle and the lobes of the lateral united petals that are terminated by a long filamentous bristle. However, the new species differs from the latter in its narrowly elliptic to oblanceolate leaf blade, the smaller lateral sepals with entire margins and a prominent green cornute appendage dorsally, the spur of the lower sepal that is entire at the tip, and its differing leaf epidermis micromorphology. The micromorphology of seeds and pollen under SEM is presented.

Key words: Balsaminaceae, China, Guangxi, *Impatiens*, IUCN Red List.

The genus *Impatiens* L. belongs to the family Balsaminaceae, which contains two currently recognized genera, the small *Hydrocera* Blume and the prolific *Impatiens*. This genus contains about 850 species (Grey-Wilson, 1980; Fischer, 2004) distributed mainly in the Old World, throughout much of tropical Africa (including Madagascar), India, southwestern Asia, southern and central China, and Japan. There are also a few species that extend into the northern temperate zones of Europe and North America (Grey-Wilson, 1980).

In the last floristic treatment of *Impatiens* in China (Chen, 2001; Chen et al., 2008), 220 species were recognized, the majority from southwestern China in Yunnan, Sichuan, Guizhou, Xizang (Tibet), and Guangxi. Since 2001, several new species and varieties have been published from Yunnan, Guangxi, and Zhejiang (Jin & Ding, 2002; Huang et al., 2003; Yu et al., 2007). However, the high diversity and insufficient fieldwork on *Impatiens* suggest that additional new species await discovery.

The first author carried out numerous field explorations in southern China from 2004 to 2007. The species described here was confirmed as new after detailed comparison with previously described species.

Impatiens cornutisepala S. X. Yu, Y. L. Chen & H. N. Qin, sp. nov. TYPE: China. Guangxi: Quanzhou Co., Jiaojiang, in valley near river, 25°30′49″N, 110°55′17″E, ca. 1000–1300 m, 6 Oct. 2006, *S. X. Yu 4023* (holotype, PE; isotype, IBK, MO). Figure 1.

Species ob pedunculum uniflorum et lobulos petalorum lateralium connatorum apice in trichomata longa desinentes *Impatienti dicentrae* Franchet ex Hooker f. similis, sed ab ea foliis anguste ellipticis vel obovato-ellipticis, sepalis lateralibus parvis margine integris dorsaliter appendicibus corniformibus viridibus praeditis atque calcari apice integro differt.

Annual herb, (30–)60–80 cm tall, glabrous; stems erect, branched, lower nodes swollen with numerous fibrous roots. Leaves submembranous, alternate, petiolate or uppermost subsessile; petiole 0.5–2 cm; leaf blades narrowly elliptic to oblanceolate, 12–15 × 3–5 cm, apex acuminate to cuspidate, base orbicular to cordate, with many stipitate glands scattered at the base, margin crenate, teeth mucronate, lateral veins in 5 to 7 pairs, arcuate, midvein abaxially prominent. Inflorescence in upper leaf axils, solitary, 1-flowered, peduncles 2–3 cm, glabrous, bracteate above middle; bracts solitary, elliptic-ovate, 1–2 mm, entire, persistent. Flowers yellow, 4–5 cm; lateral sepals 2, ovate, 4–5 × 2–3 mm, apex acuminate, dorsally with a green spinelike appendage 2–3 mm, base with reddish patches; lower sepal infundibuliform, ca. 2 cm, mouth truncate, apex acute, reddish striate, base gradually narrowed into spur; spur 1–1.5 cm, incurved, apex not bilobed; dorsal petal reniform, 1.2–1.5 × 1.8–2 cm, base truncate, apex curved abaxially to a cusp, dorsally with a green mucro ca. 5 mm, abaxially with a green spinelike crest or appendage ca. 5 mm, base with reddish patches; lateral united petals not clawed,

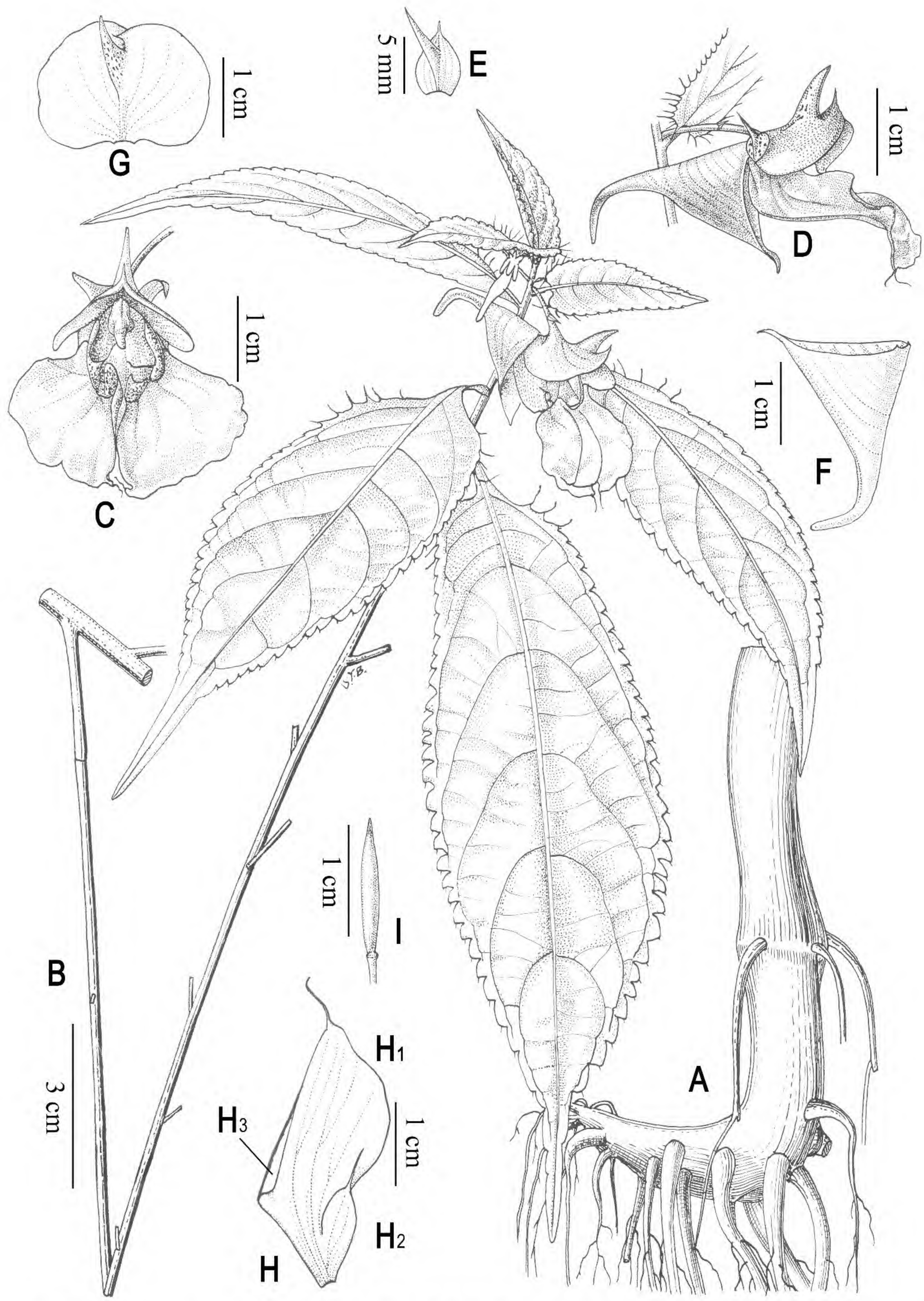

Figure 1. *Impatiens cornutisepala* S. X. Yu, Y. L. Chen & H. N. Qin. —A. Root. —B. Flowering branch. —C. Flower (front view). —D. Flower (lateral view). —E. Lateral sepal. —F. Lower sepal. —G. Dorsal petal. —H. Lateral united petals: H1, lower petal of lateral united petals; H2, upper petal of lateral united petals; H3, auricle. —I. Fruit. Drawn by Y. B. Sun from the holotype *S. X. Yu 4023* (PE).

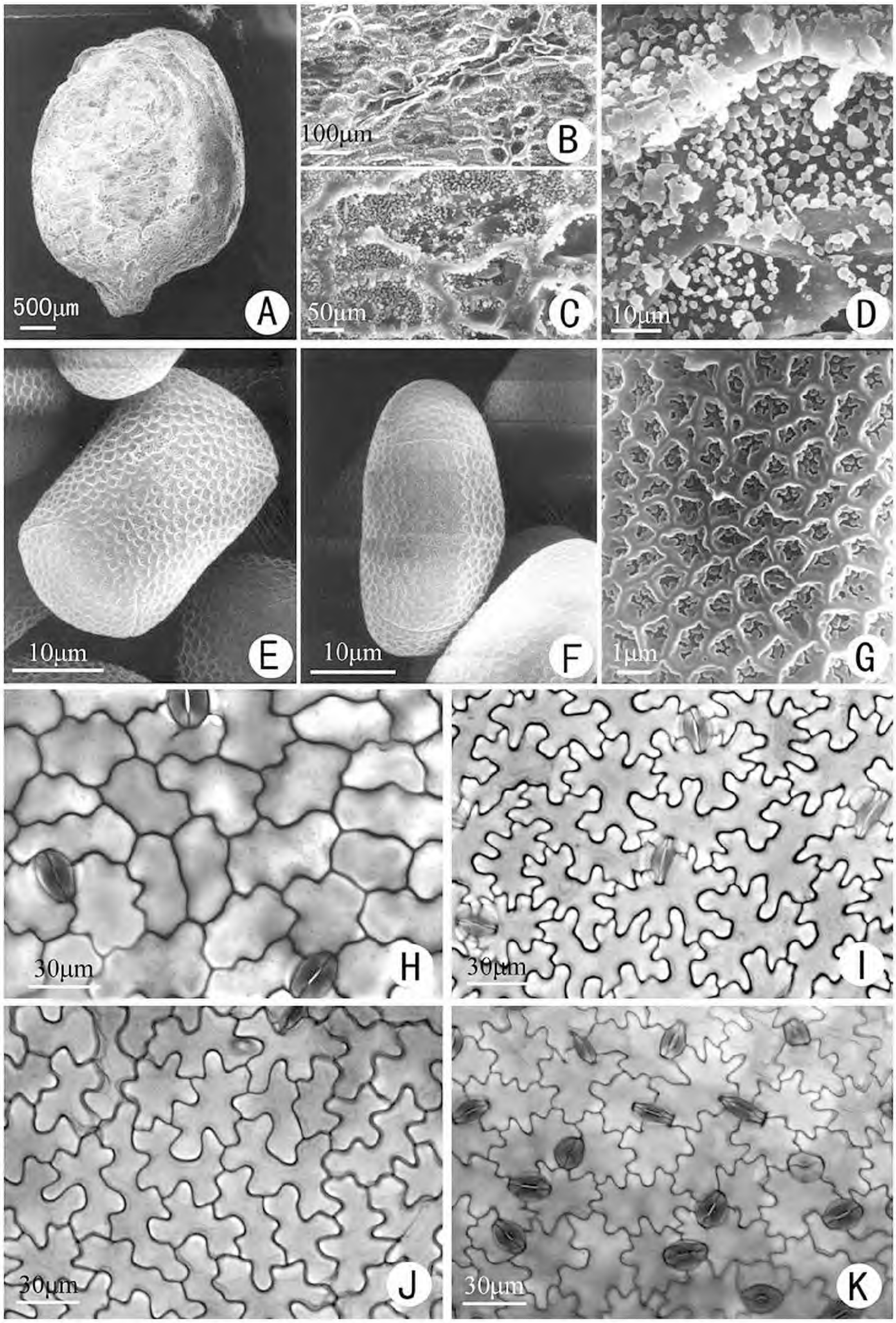

Figure 2. A–I. *Impatiens cornutisepala* S. X. Yu, Y. L. Chen & H. N. Qin. A–D. SEM images of seeds. —A. Entire view to show the shape of the seed. —B, C. Partial view to show the reticulate ornaments. —D. Partial view to show the ornaments in the lumina. E–G. SEM images of pollen grains. —E. Polar or short equatorial view to show the shape of the pollen grain and its four colpi. —F. Long equatorial view to show the shape of the pollen grain. —G. Partial view to show the reticulate ornaments. H, I. Light photomicrographs of epidermis cells. —H. Adaxial epidermis to show the cells and stomata. —I. Abaxial epidermis to show the cells and stomata. J, K. *Impatiens dicentra*, light photomicrographs of epidermis cells. —J. Adaxial epidermis to show the cells and stomata. —K. Abaxial epidermis to show the cells and stomata. A–I from *S. X. Yu 4023* (PE); J, K from *S. X. Yu 4093* (PE).

ca. 2 cm, 2-lobed; upper petal of the lateral united petals ovate-lanceolate, 5–7 mm, upper part with reddish patches, apex acuminate into long filamentous trichomes; lower petal dolabriform, 1.2–1.5 cm, incurved, inner margin curled, with small auricle, apex abruptly narrowed into long filamentous trichomes; stamen filaments, 2–3 mm linear; anthers small, ca. 5 mm, apex obtuse; ovary 4–5 mm, fusiform, erect, apex acuminate, glabrous. Capsule 2–2.5 cm, cylindrical, many-seeded, acuminate, glabrous; seeds ca. 3.33 × 2.83 mm, with a length:width ratio of 1.18, orbicular-ovoid, brown, obviously reticulate (Fig. 2A–D).

Pollen grains (P [polar length] × E1 [long equatorial length] × E2 [short equatorial length]) 14.3(13.8–14.6) × 27.8(27.2–28.1) × 16.7(16.3–17.5) μm, tetracolpate, colpi long, thin, exine with reticulate ornamentation, dense granules in lumina (Fig. 2E–G).

Distribution and ecology. *Impatiens cornutisepala* is endemic to northeastern Guangxi Province, China, recorded so far only from Quanzhou County. The plants were found in a moist valley in Jiaojiang village from 1000–1300 m elevation, in association with *Pilea* Lindley, *Elatostema* J. R. Forster & G. Forster, *Carex* L., an unidentified bamboo species, and other grasses.

IUCN Red List category. The population covers an area of about 1000 m^2 and includes approximately 500 to 600 individuals. According to IUCN Red List criteria (IUCN, 2001), *Impatiens cornutisepala* should be categorized as Critically Endangered (CR).

Phenology. The new species was observed in flower from July to October and in fruit from August to November.

Etymology. The specific epithet *cornutisepala* is from the Latin and refers to the lateral sepals with their green cornute appendages.

Leaf anatomy. The leaf epidermis of the two species, *Impatiens cornutisepala* (Fig. 2H, I) and *I. dicentra* Franchet ex Hooker f. (Fig. 2J, K), are both irregular, with stomata on both sides of the leaf. The stomata are anomocytic, and the guard cell outlines are suborbicular. However, the anticlinal walls of the adaxial epidermis differ: wavy or sinuous in *I. cornutisepala*, but with deeper crenulations in *I. dicentra*. In contrast, on the abaxial epidermis, the cell walls of the two species both seemed deeply crenulate, but the stomatal density (SD) and stomatal index (SI) (Dilcher, 1974) differ: *I. cornutisepala*: SI (adaxial epidermis) = 7.32%–9.46%, SI (abaxial epidermis) = 17.84%–22.4%; *I. dicentra:* SI (adaxial epidermis) = 2.61%–4.27%, SI (abaxial epidermis) = 33.72%–38.41%.

Taxonomic relationships. *Impatiens cornutisepala* is morphologically similar to *I. dicentra* in its single-flowered peduncles and in the lobes of the lateral united petals that are tipped by long hairlike processes. However, the two species differ in the narrowly elliptic to oblanceolate leaves (vs. ovate to ovate-lanceolate in *I. dicentra*), smaller lateral sepals (4–5 × 2–3 mm) with entire margins and conspicuous dorsal spinelike appendages (vs. larger sepals [7–9 × 5–6 mm] with crenate margins and no dorsal spinelike appendages in *I. dicentra*), and the spur of the lower sepal that is entire at the tip (vs. bilobed in *I. dicentra*).

Three species, *Impatiens macrovexilla* Y. L. Chen, *I. siculifer* Hooker f., and *I. cyanantha* Hooker f., are sympatric in Guangxi Province with *I. cornutisepala*. These four species are readily distinguished by their reproductive and vegetative characters in the following key.

KEY TO FOUR SPECIES OF *IMPATIENS* IN GUANGXI PROVINCE, CHINA

1a. Inflorescences in upper leaf axils, 1- to 2-flowered, flowers red or yellow 2
1b. Inflorescences in upper leaf axils, racemes, 5- to 7-flowered, flowers yellow or purple 3
2a. Flowers yellow, apices of lateral united petals with trichomes . . . . . *I. cornutisepala*
2b. Flowers yellow, apices of lateral united petals entire . . . . . *I. macrovexilla*
3a. Flowers golden yellow, lower sepal narrowly funnelform . . . . . *I. siculifer*
3b. Flowers purple, lower sepal widely funnelform . . . . . *I. cyanantha*

Paratypes. CHINA. **Guangxi:** Quanzhou Co., Jiaojiang, in valley near river, ca. 1200 m, 18 Nov. 2007, *W. B. Xu 200711183a* (IBK, MO).

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A New Species of *Epimedium* (Berberidaceae) from Hubei, China

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ABSTRACT. A new species of *Epimedium* L. (Berberidaceae), *E. shennongjiaensis* Yan J. Zhang & J. Q. Li, is described and illustrated from the Shennongjia National Nature Reserve, Hubei Province, China. The new species is distinctive and assigned to series *Davidianae* Stearn of section *Diphyllon* (Komarov) Stearn because of its large flowers and petals with expanded lamina and elongated spurs. Based on corolla characteristics, it is similar to *E. epsteinii* Stearn but is distinguished by its compact rhizomes, narrowly ovate and acuminate inner sepals (1.5–1.9 × 0.7–0.9 cm), and petals slightly shorter or nearly as long as the inner sepals with straight spurs (1.5–1.7 cm).

Key words: Berberidaceae, China, *Epimedium*, Hubei, IUCN Red List.

Epimedium L., as a temperate genus of Old World distribution, is the largest genus of herbaceous Berberidaceae with ca. 57 species distributed broadly from Japan to Algeria. China, where 47 species have been reported and the evolution of *Epimedium* has continued without interruption probably since the origin of the genus, is not only the richest in species of *Epimedium*, it is the only region where new species continue to be found (Ying, 2001; Stearn, 2002; He & Xu, 2003; Guo et al., 2007).

The new species was collected from Muyuping, Shennongjia National Nature Reserve, Hubei Province, China, on 2 May 2004, when it was flowering; it was then transplanted into the Wuhan Botanical Garden, Chinese Academy of Sciences, also in Hubei Province. It appears most closely related to *Epimedium epsteinii* Stearn, but differs from the latter in its rhizomes, leaflets, and perianth.

Epimedium shennongjiaensis Yan J. Zhang & J. Q. Li, sp. nov. TYPE: China. Hubei: cultivated at Wuhan Botanical Garden, CAS [collected in Muyuping, Shennongjia Natl. Nature Reserve], 30 Mar. 2007, *Y. J. Zhang 148* (holotype, HIB; isotype, HIB). Figure 1.

Species nova *Epimedio epsteinii* Stearn affinis, sed ab eo rhizomatibus compactis, foliis basi profunde cordatis, sepalis interioribus anguste ovatis apice acuminatis atque petalis sepalis interioribus paulo brevioribus vel aequilongis calcaribus strictis differt.

Flowering stems 18 cm or longer, bearing 2 opposite leaves or a single leaf; *rhizome* compact, 4.5–8 mm diam. *Basal and cauline leaves* with 3 leaflets; leaflets narrowly ovate, 6.5–11.2 × 3.7–6.1 cm, apex acuminate, margin spinose-serrate, base deeply cordate with a narrow sinus, lobes of the terminal leaflet equal and acute, those of the lateral leaflets very unequal with the inner lobe smaller and acute, and the outer one much larger and acute, coriaceous, persisting as green all winter, glossy adaxially, glaucous abaxially when mature and glabrate with scattered, minute, erect hairs. *Inflorescence* simple, racemose, few-flowered, with 8 to 22 flowers, 10–17 cm; pedicels ca. 2–2.7 cm, glabrous or sometimes glandular. *Flowers* large, 3–3.8 cm diam.; *outer sepals* soon falling, green or purple, outer pair oblong, to 4 mm, inner pair broadly ovate with white margins, to 5 mm; *inner sepals* narrowly ovate, white, 1.5–1.9 × 0.7–0.9 cm, apex acuminate; *petals* slightly shorter or nearly as long as inner sepals, deep purple; spur subulate, straight, 1.5–1.7 cm, expanded at base into lamina 5–6 mm high; *stamens* enclosed by the upward corolla extension, ca. 4 mm; filaments white, ca. 1 mm; anthers ca. 3 mm, pale yellow; pollen yellow. *Capsule* ca. 1 cm.

Habitat and distribution. *Epimedium shennongjiaensis* is found in forests and on valley slopes at ca. 1500 m elevation in Muyuping, Shennongjia National Nature Reserve, Hubei Province, China.

IUCN Red List category. *Epimedium shennongjiaensis* is assessed as a taxon of Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

Phenology. The new species is known to flower in May in the field and in late March to mid April in cultivation.

Etymology. The specific epithet refers to the type locality.

Discussion. Stearn (2002) established section *Diphyllon* (Komarov) Stearn, which comprised all the Chinese species of *Epimedium* except for *E. koreanum* Nakai, and he divided the section into four series

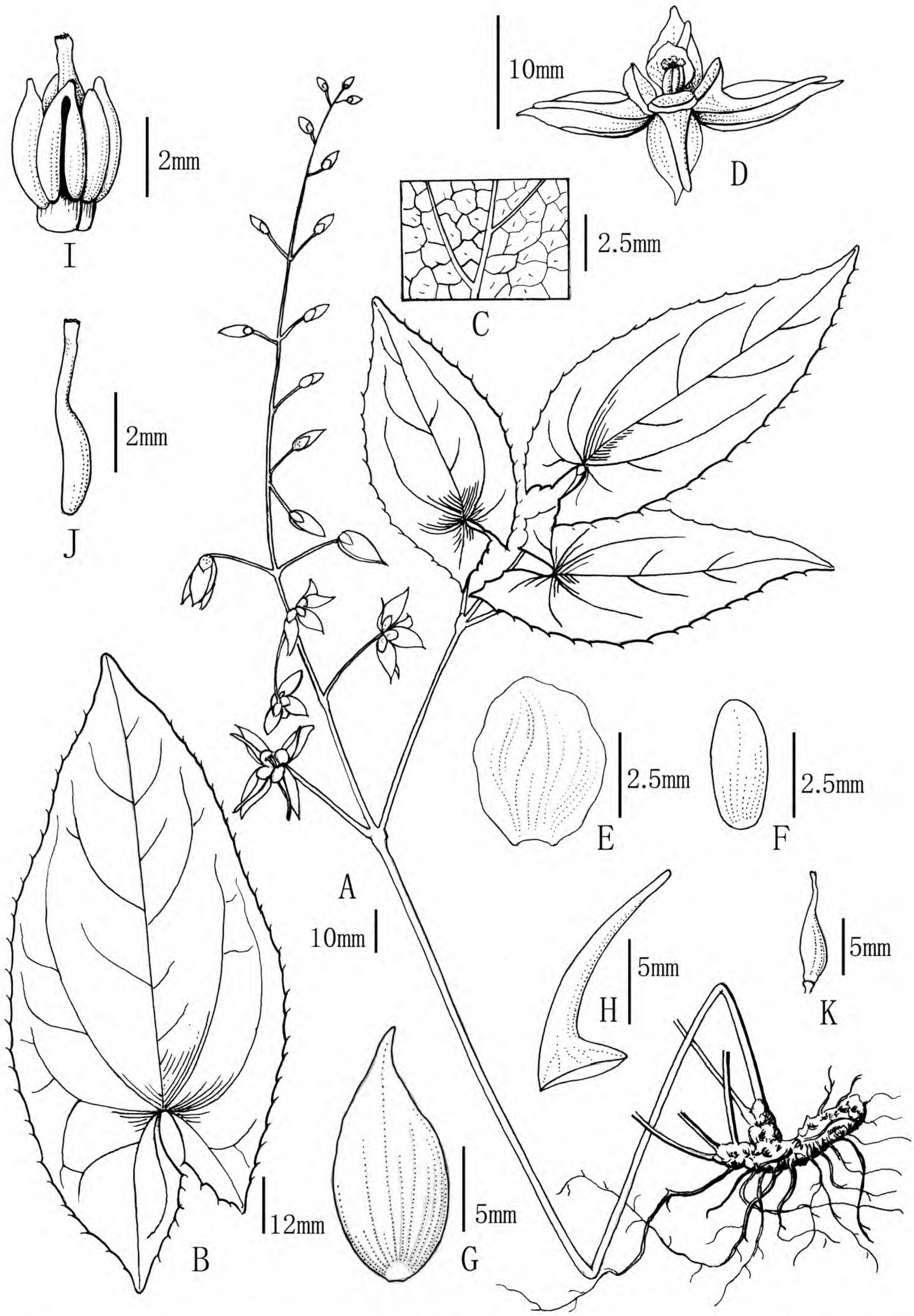

Figure 1. *Epimedium shennongjiaensis* Yan J. Zhang & J. Q. Li. —A. Habit. —B. Mature lateral leaflet. —C. Detail of abaxial leaf surface. —D. Flower. —E. Outer sepal, inner pair. —F. Outer sepal, outer pair. —G. Inner sepal. —H. Petal. —I. Stamens and gynoecium. —J. Gynoecium. —K. Fruit. Drawn by G. X. Chen from the holotype *Y. J. Zhang 148* (HIB).

based on corolla characteristics. *Epimedium shennongjiaensis* belongs to series *Davidianae* Stearn of section *Diphyllon*, which is characterized by large flowers and petals with expanded lamina and elongated spurs. Stearn (2002) ascribed 10 species to series *Davidianae*, differentiated mostly by rhizome morphology, leaflet number and morphology, and inflorescence and corolla characteristics. Recently,

Guo et al. (2007) reported *E. pseudowushanense* B. L. Guo and placed the new species in series *Davidianae*, bringing the total number of species in series *Davidianae* to 12.

Among the 12 species of series *Davidianae*, *Epimedium shennongjiaensis* presents greatest affinity with *E. epsteinii* from Hunan Province in their similar flower form. However, *E. shennongjiaensis* is distinguished by its compact rhizomes (vs. creeping and slender in *E. epsteinii*), narrowly ovate and acuminate inner sepals (vs. ovate and acute), and petals slightly shorter or nearly as long as the inner sepals with straight spurs (vs. petals a little longer than the inner sepals with slightly curved spur). In addition, *E. shennongjiaensis* has leaflets with the base deeply cordate and with a narrow sinus (vs. shallowly cordate with the lobes separated by moderately wide sinus) and the lobes of the terminal and lateral leaflets are acute (vs. rounded except for the larger lobes of lateral leaflets which are acute). In general, *E. shennongjiaensis* is a distinct species that can be distinguished from the other species of series *Davidianae* by its compact rhizome, leaflet number and morphology, simple inflorescence, flower color, and shape and size of inner sepal and petal.

KEY TO SPECIES OF *EPIMEDIUM* SER. *DAVIDIANAE*

1a. Leaflets 5, rarely 3.
  2a. Inner sepals reddish, ca. 4 × 1 mm; spur of petals much longer than inner sepals, 10–15 mm long . . . . . *E. davidii* Franchet
  2b. Inner sepals pale sulphur yellow, ca. 11 × 4 mm; spur of petals slightly longer than inner sepals, ca. 13 mm long . . . . . *E. flavum* Stearn
1b. Leaflets 3.
  3a. Inflorescences racemes.
    4a. Rhizome compact, 4.5–8 mm diam. . . . . *E. shennongjiaensis* Yan J. Zhang & J. Q. Li
    4b. Rhizome long-creeping, 1–3 mm diam.
      5a. Leaflets broadly ovate or almost orbicular, 1.3–2.5 × 1.2–2.5 cm . . . . . *E. pauciflorum* K. C. Yen
      5b. Leaflets ovate or narrowly ovate, 3–11 cm long.
        6a. Spur of petals much longer than inner sepals.
          7a. Inner sepals cymbiform, reddish, ca. 6 × 2.5 mm, apex obtuse; petals pale yellow . . . . . *E. fangii* Stearn
          7b. Inner sepals elliptic, white, ca. 16 × 8–9 mm, apex shortly acuminate; petals white . . . . . *E. latisepalum* Stearn
        6b. Spur of petals a little longer than inner sepals, or almost as long as inner sepals.
          8a. Inner sepals ovate, ca. 13 × 9 mm, apex acute; petals purple, spurs a little longer than inner sepals, 15–16 mm long. . . . . *E. epsteinii* Stearn
          8b. Inner sepals lanceolate, 16–19 × 7–9 mm, apex acuminate; petals white, spurs almost as long as inner sepals, 15–18 mm long . . . . . *E. ogisui* Stearn
  3b. Inflorescences panicles.
    9a. Petals with obvious basal lamina 7–8 mm high.
      10a. Leaflets narrowly ovate, 10–13 × ca. 6 mm, apex acuminate; inner sepals broadly elliptic, reddish, 5–6 × 3–4 mm . . . . . *E. hunanense* (Handel-Mazzetti) Handel-Mazzetti
      10b. Leaflets lanceolate, 5–7 × 1.2–3 mm, apex long acuminate; inner sepals elliptic or narrowly ovate, pale yellow, 10–12 × 5–6 mm. . . . . *E. ilicifolium* Stearn
    9b. Petals with slight basal lamina 2–3.5 mm high.
      11a. Inner sepals ovate or broadly ovate, 8–13 × 4–8 mm; spur of petals almost as long as or slightly longer than inner sepals, 10–15 mm long . . . . . *E. pseudowushanense* B. L. Guo
      11b. Inner sepals elliptic, 11–12 × 4–5.5 mm; spur of petals obviously longer than inner sepals, 17–20 mm long. . . . . *E. mikinorii* Stearn

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